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Momose et al.

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(54) **LIQUID CRYSTAL DISPLAY DEVICE AND ELECTRONIC DEVICE**

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G02F 1/1335 (2006.01)
F21V 8/00 (2006.01)

(52) **U.S. Cl.**
CPC ***G02F 1/133615*** (2013.01); ***G02B 6/009*** (2013.01); ***G02B 6/0068*** (2013.01); ***G02B 6/0073*** (2013.01); ***G02B 6/0085*** (2013.01); *G02B 6/0088* (2013.01); *G02F 2001/133317* (2013.01); *G02F 2001/133628* (2013.01); *G02F 2201/46* (2013.01)

(58) **Field of Classification Search**
CPC G02B 6/0085; G02F 2001/133317; G02F 2201/46
USPC 362/634
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(74) *Attorney, Agent, or Firm* — Oliff PLC

(57) **ABSTRACT**

A liquid crystal display device is provided which includes a liquid crystal panel, a light guide plate having a plurality of side surfaces, a plurality of light emitting elements; a light source substrate having a mounting surface on which the plurality of the light emitting elements are mounted, a light source support member made of metal, including a substrate support plate portion supporting the light source substrate, with the substrate support plate portion coming into contact with a rear surface of the mounting surface, a first surface and a second surface different from the first surface, and a metal frame accommodating the liquid crystal panel and the light guide plate, and including a first contact portion that comes into contact with the first surface and a second contact portion that comes into contact with the second surface.

4 Claims, 7 Drawing Sheets

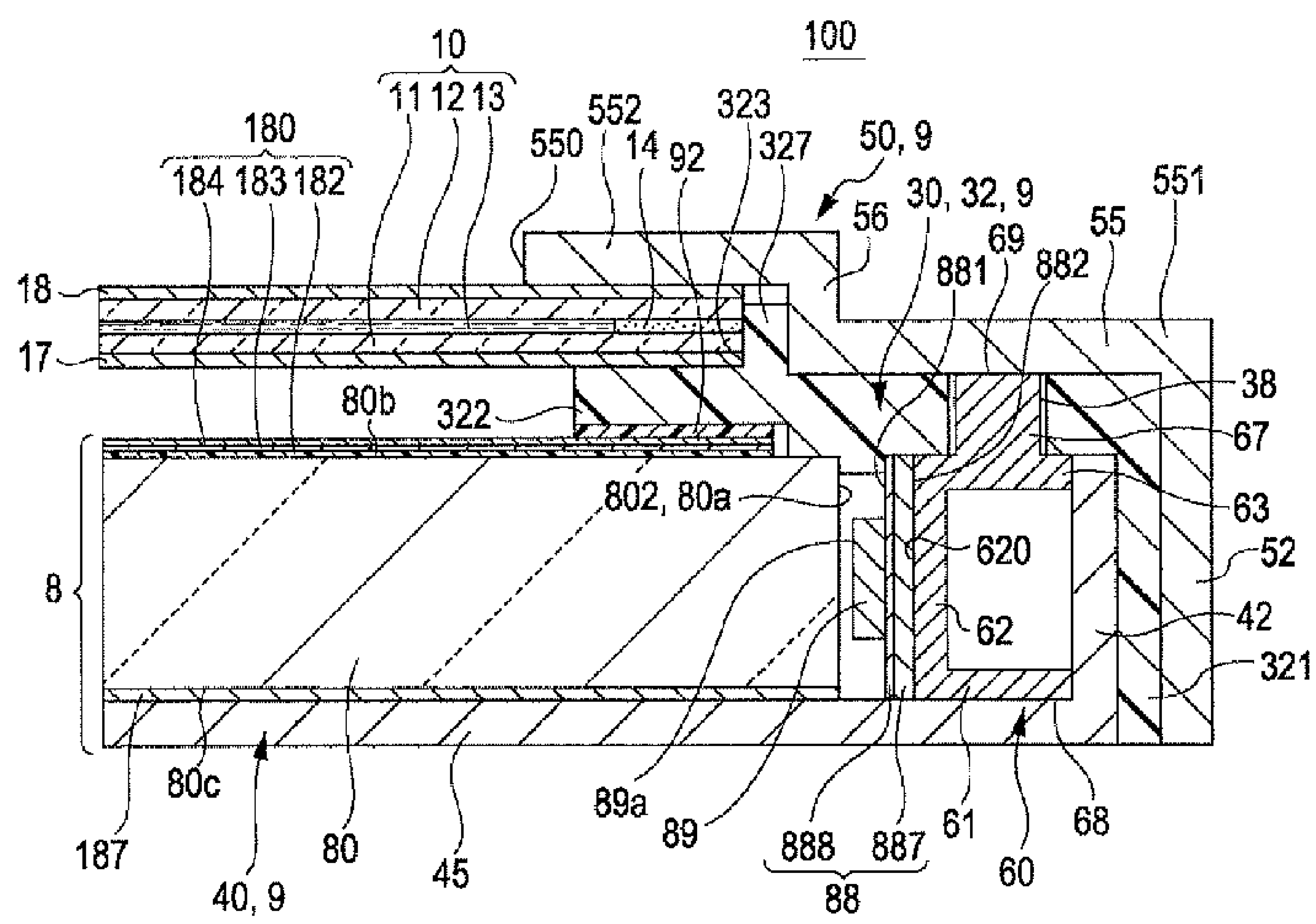

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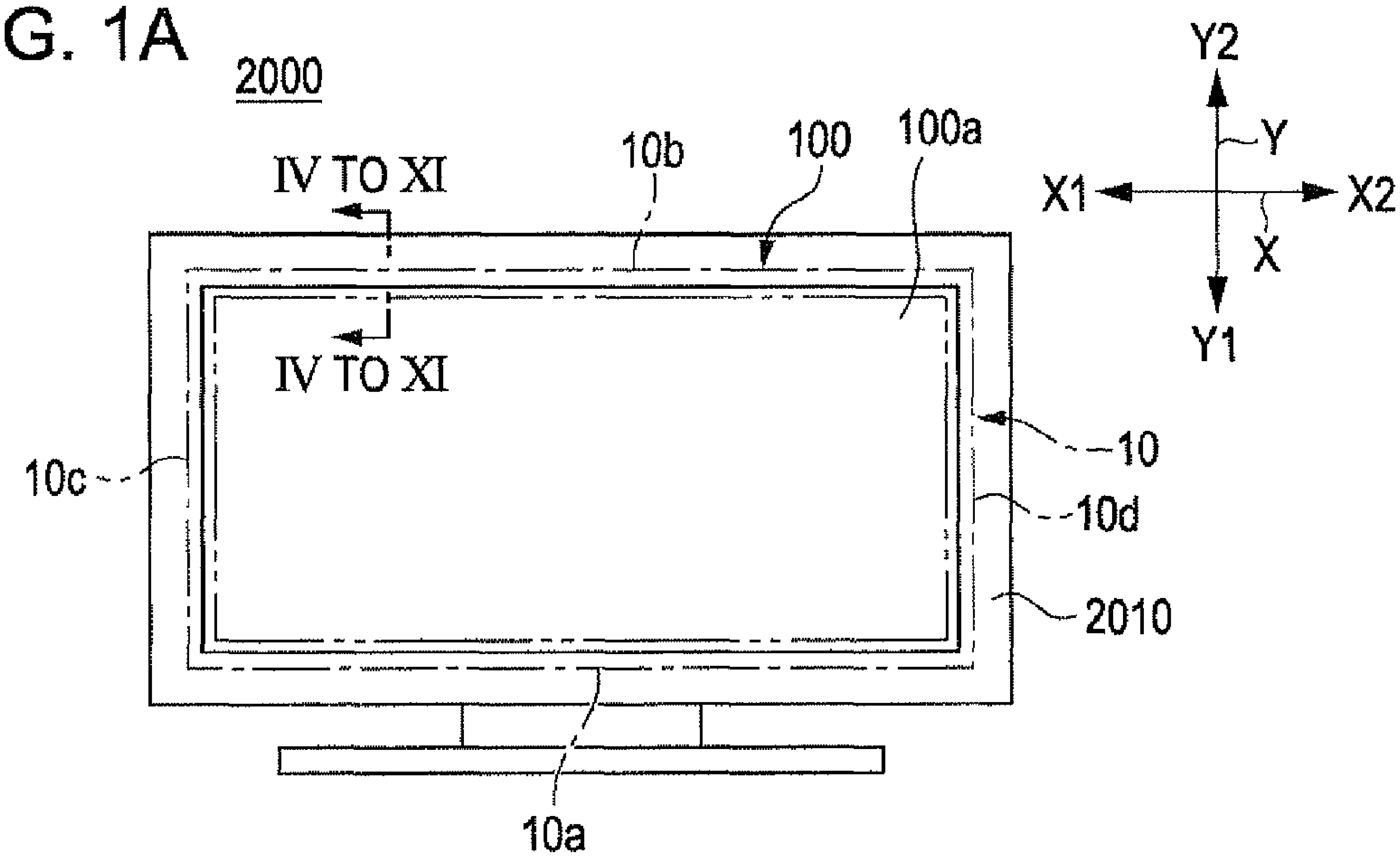
FIG. 1A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IV TO XI
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10d
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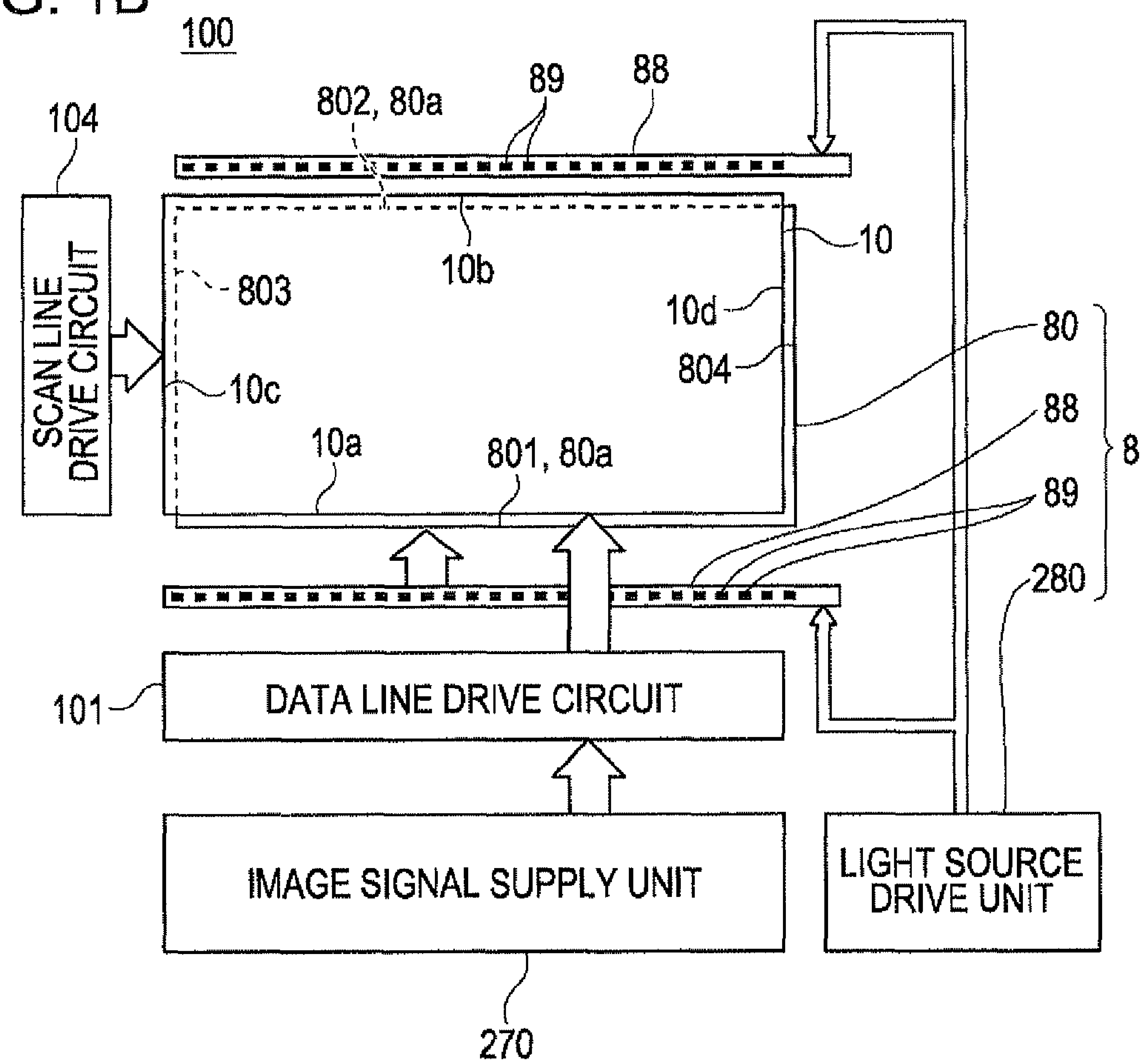
X
Y1

FIG. 1B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SCAN LINE DRIVE CIRCUIT
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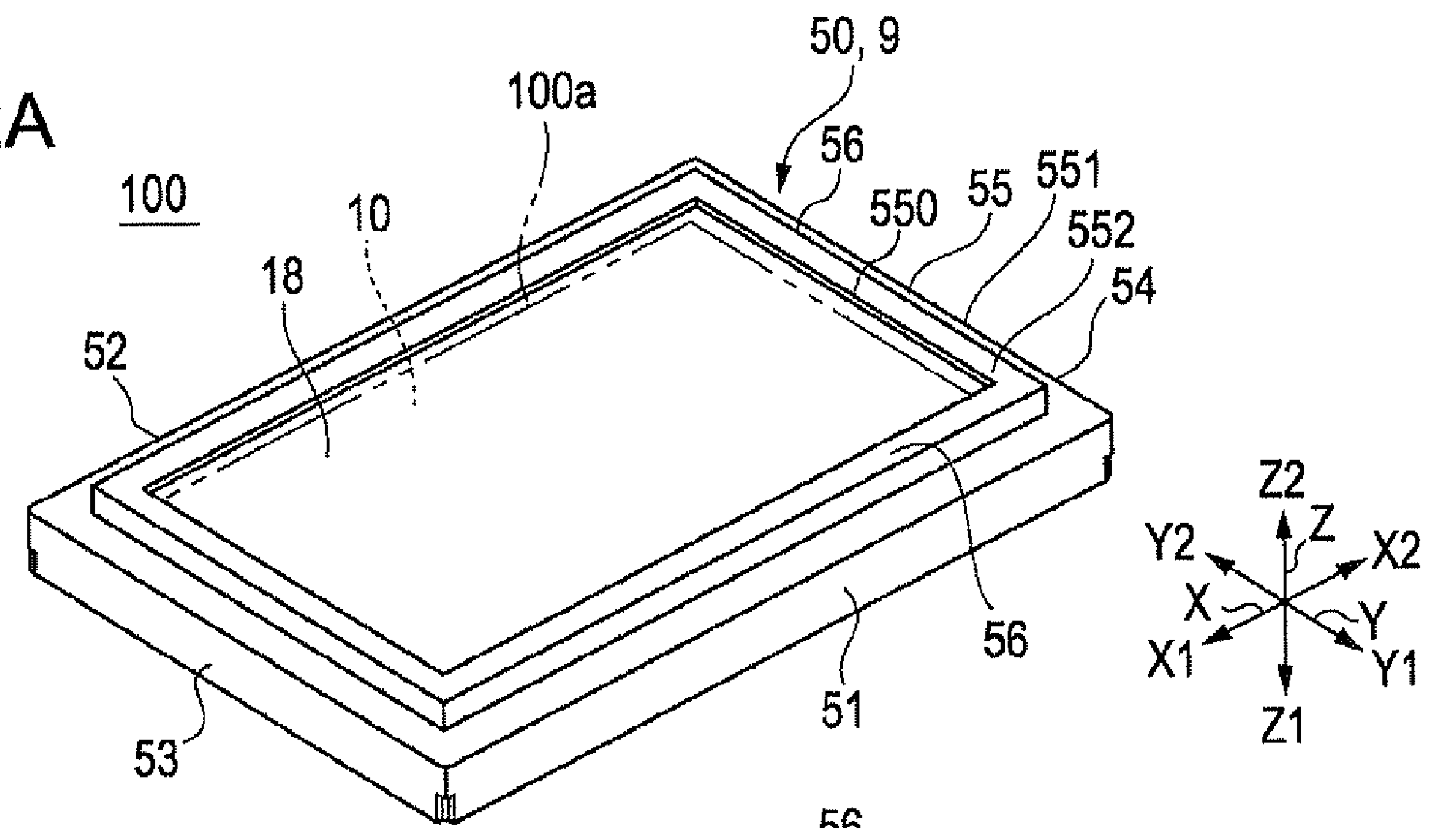
DATA LINE DRIVE CIRCUIT
IMAGE SIGNAL SUPPLY UNIT
LIGHT SOURCE DRIVE UNIT
270

FIG. 2A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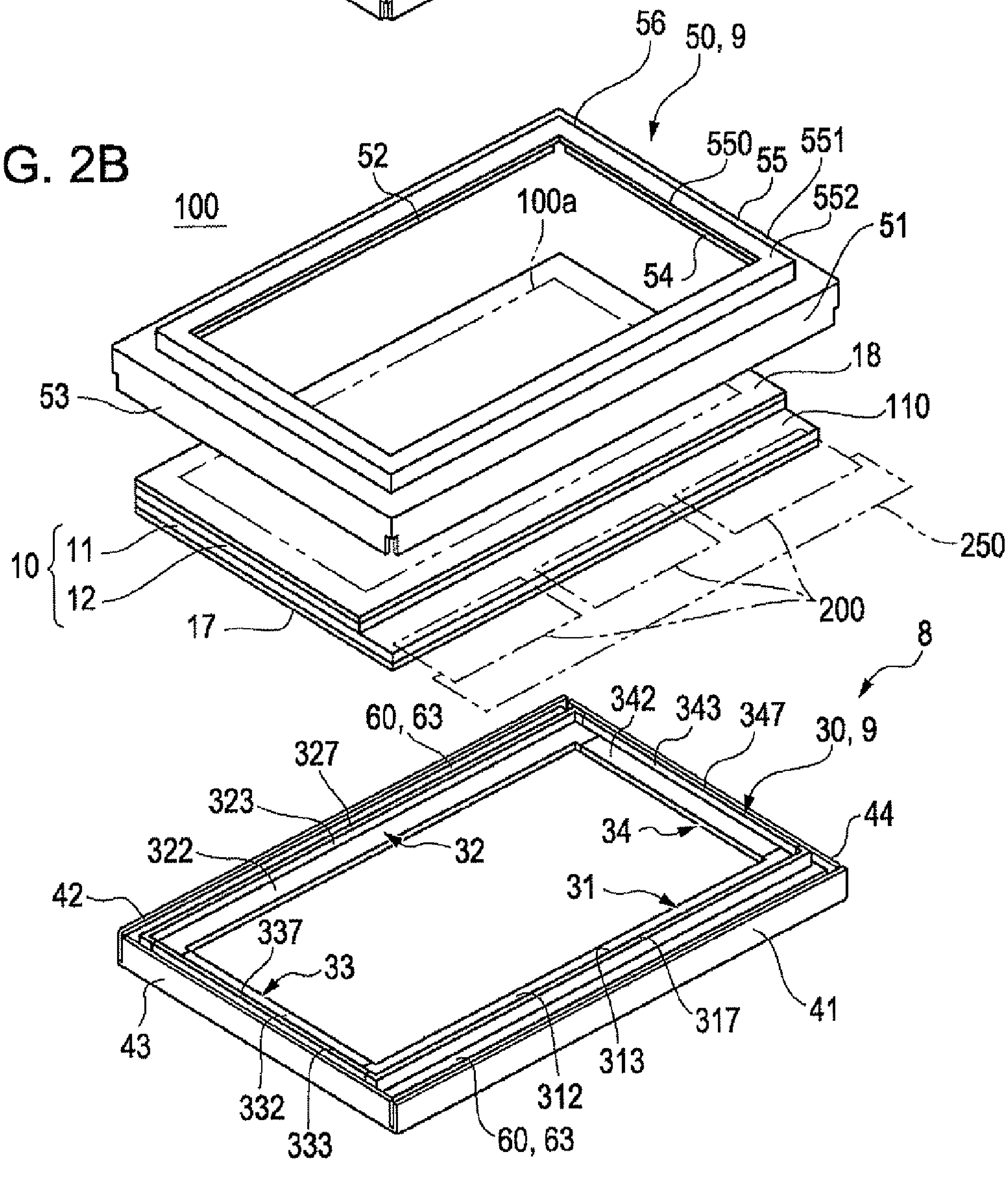
Z1

FIG. 2B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347
30, 9
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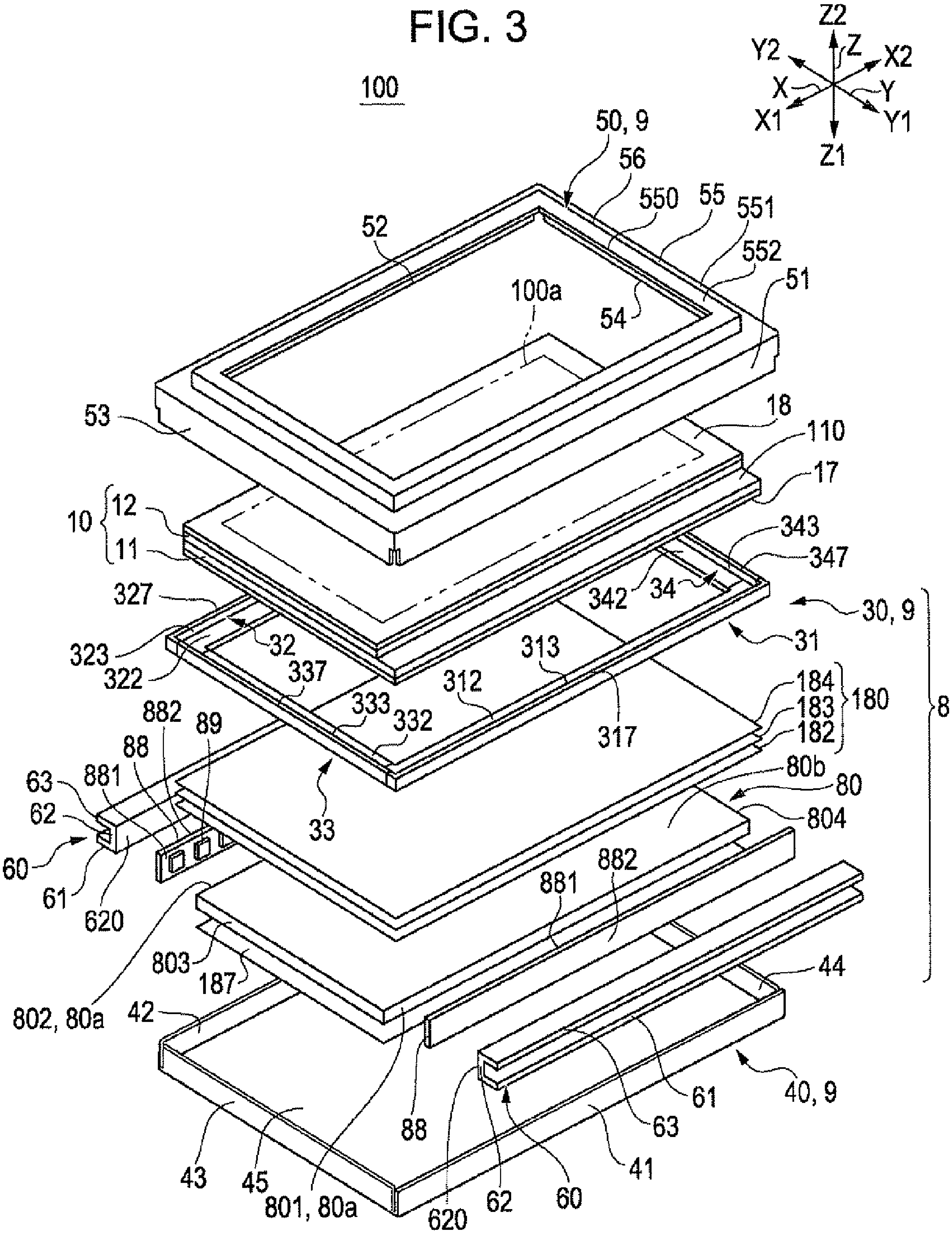
FIG. 3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804
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FIG. 4

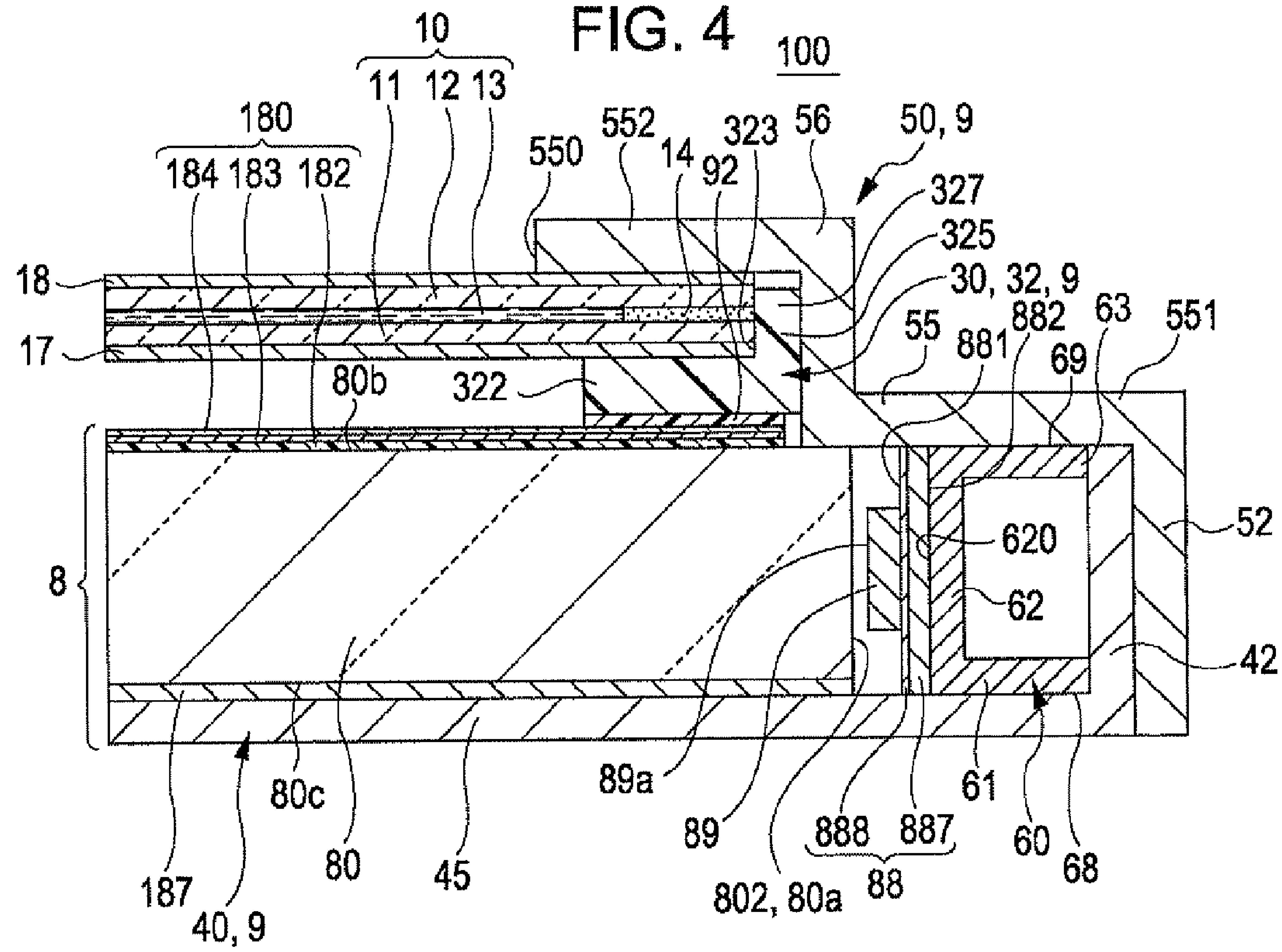
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FIG. 5

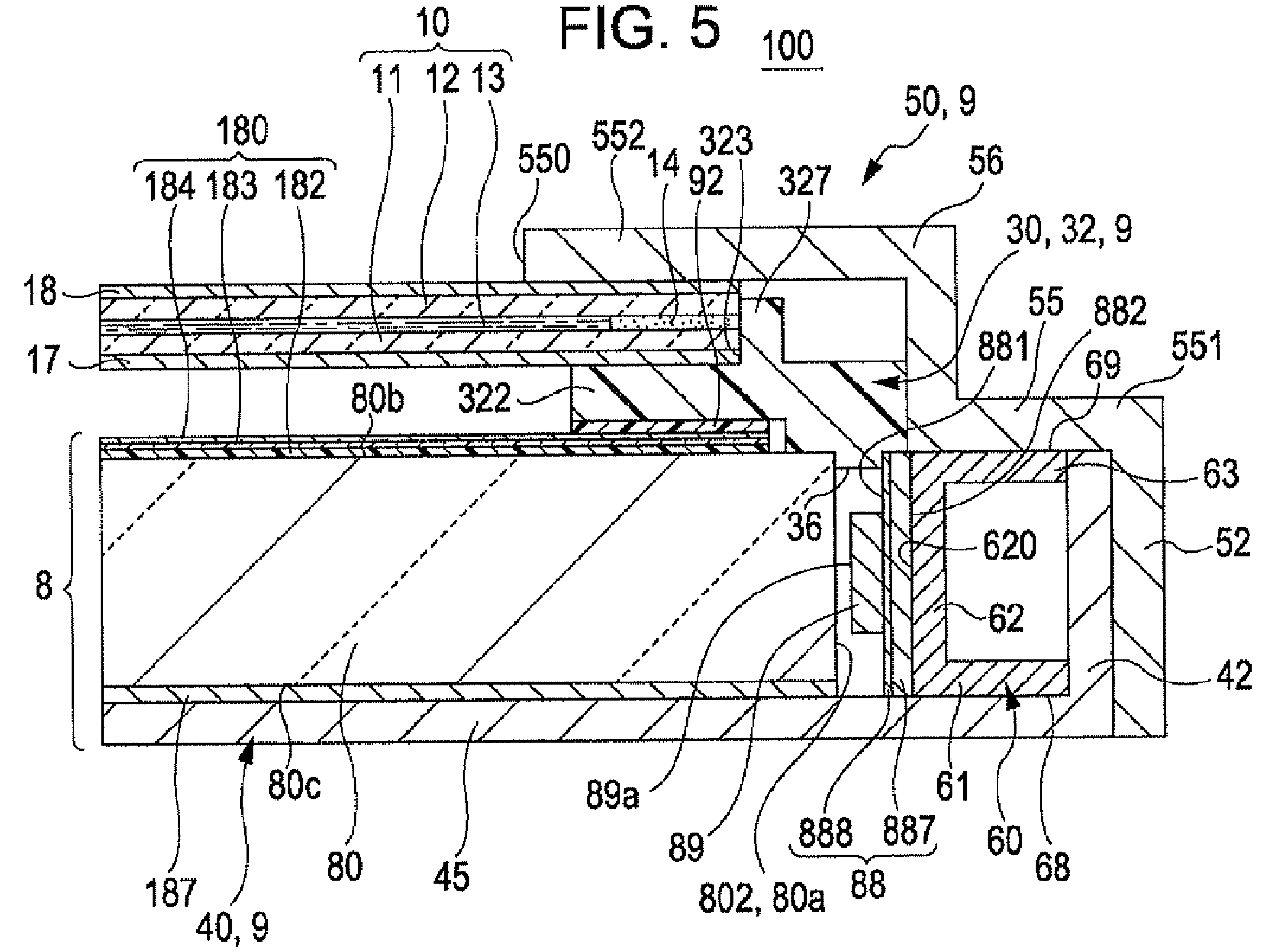
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FIG. 6

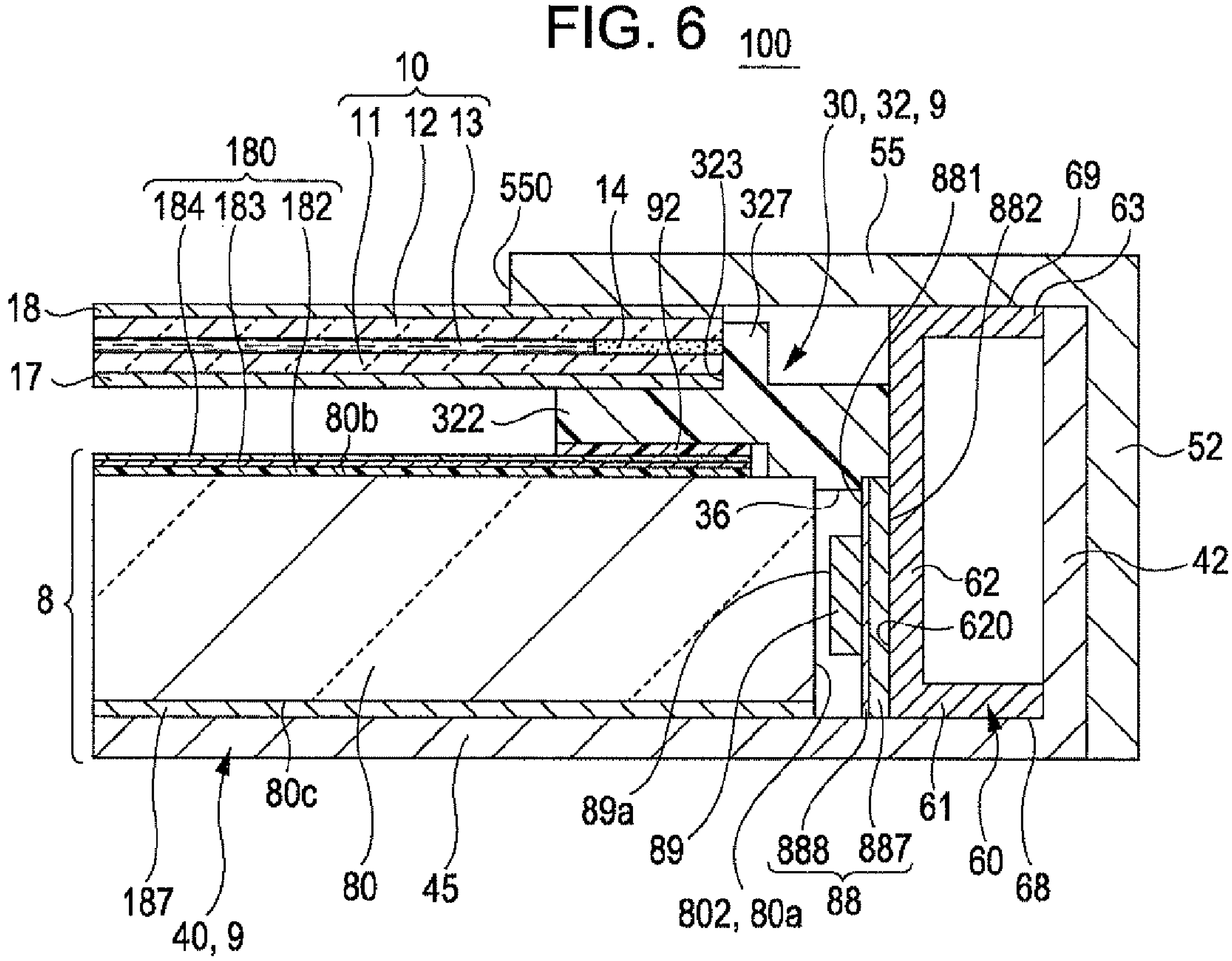
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FIG. 7

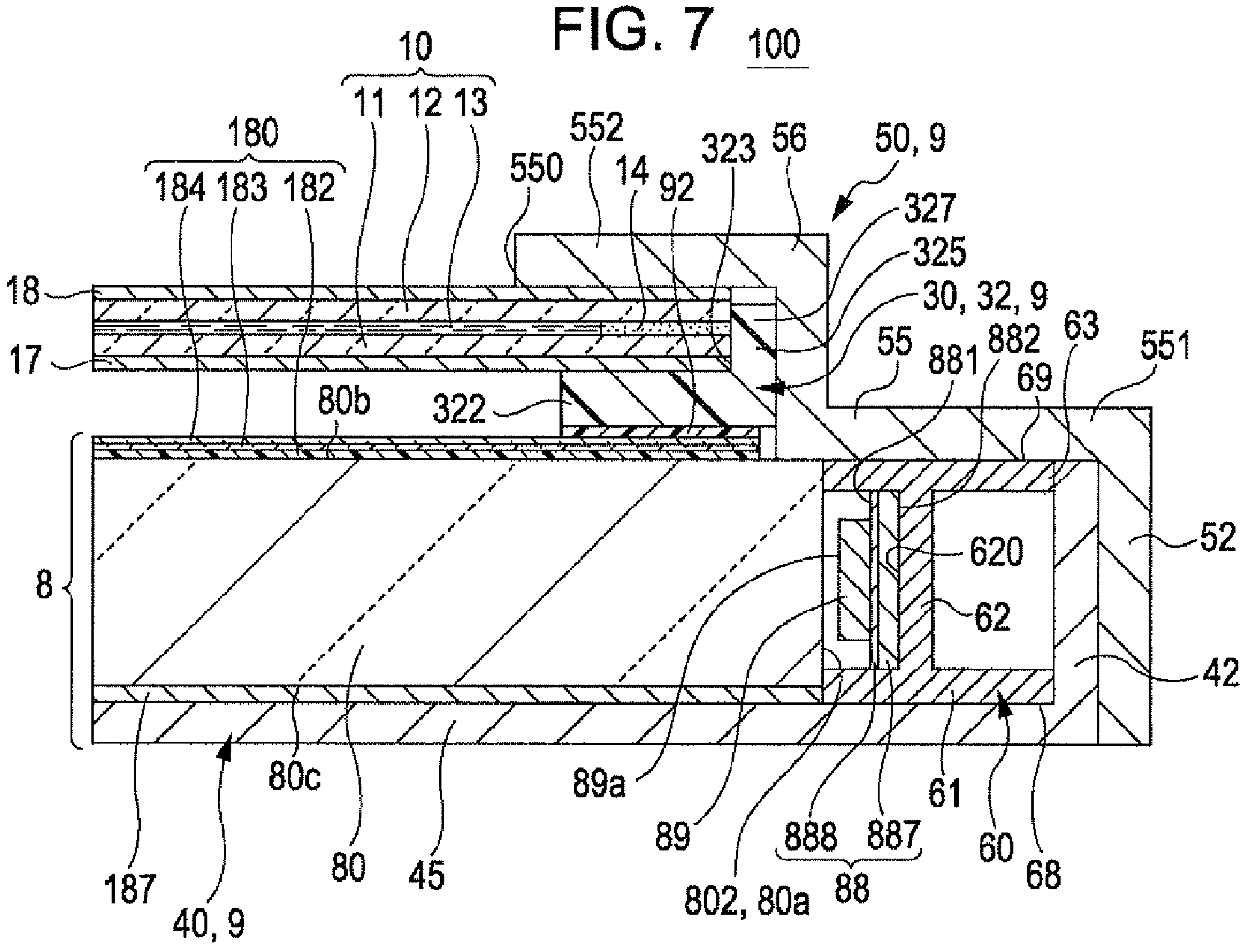
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FIG. 8 100

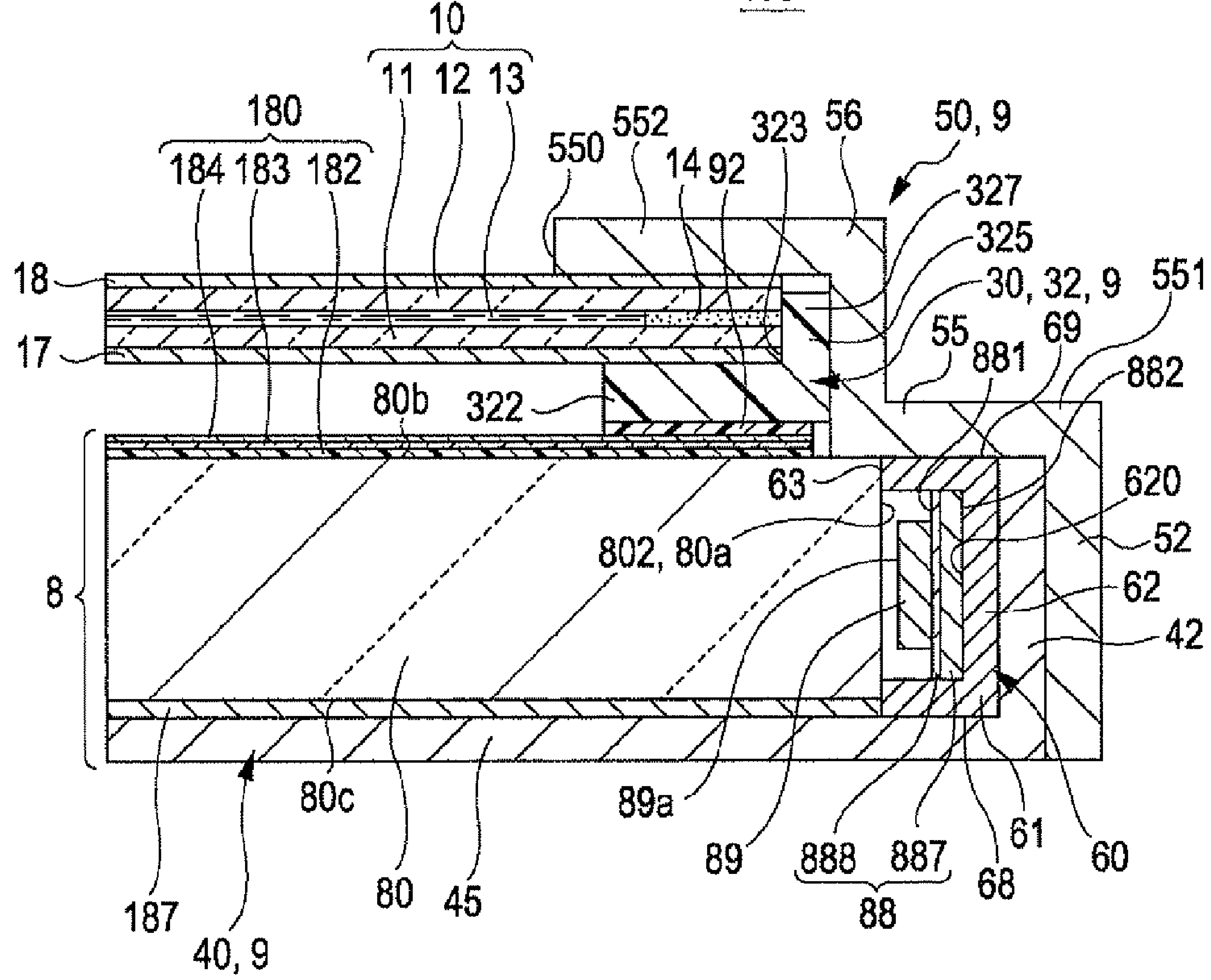

FIG. 9 100

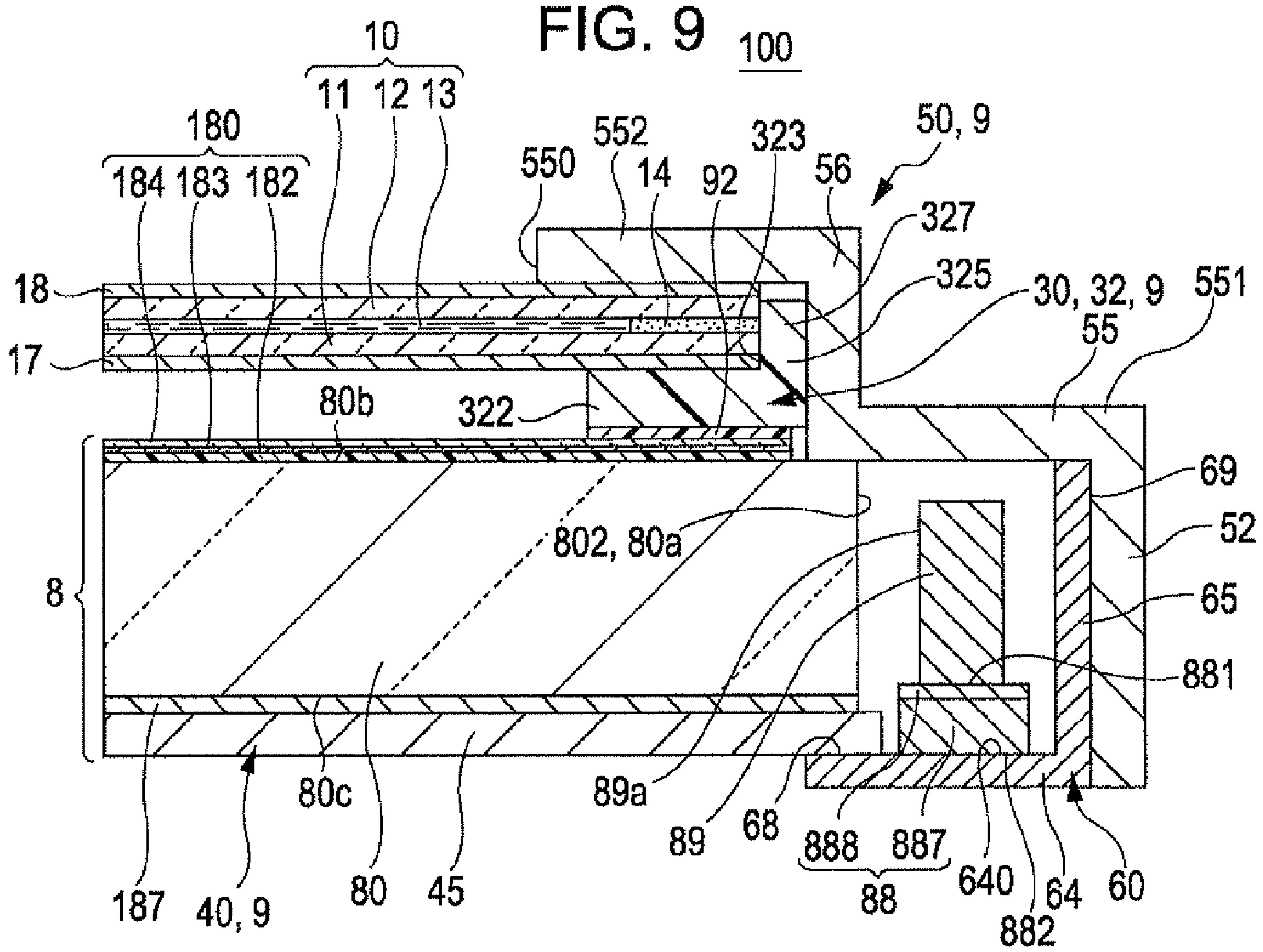

FIG. 10

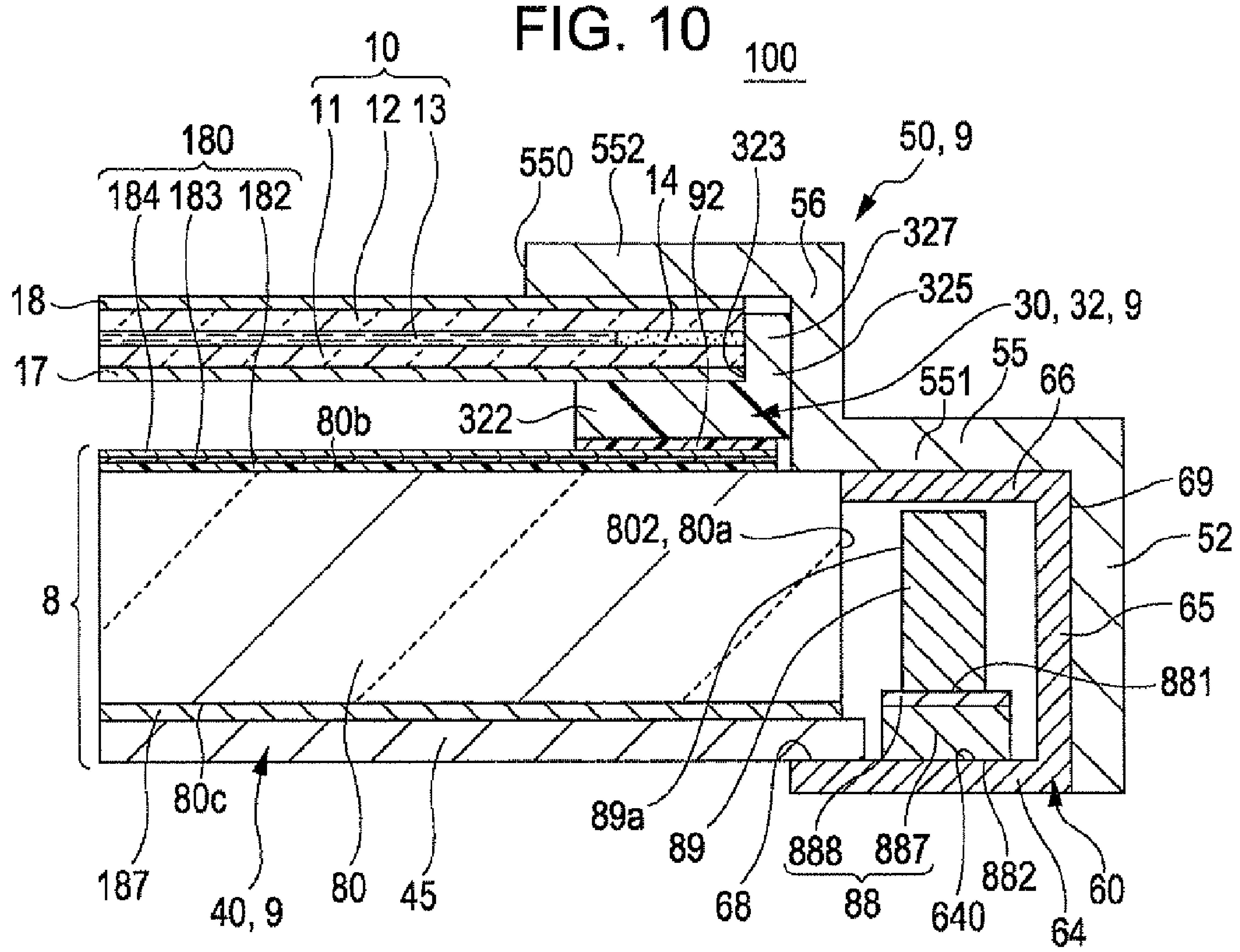
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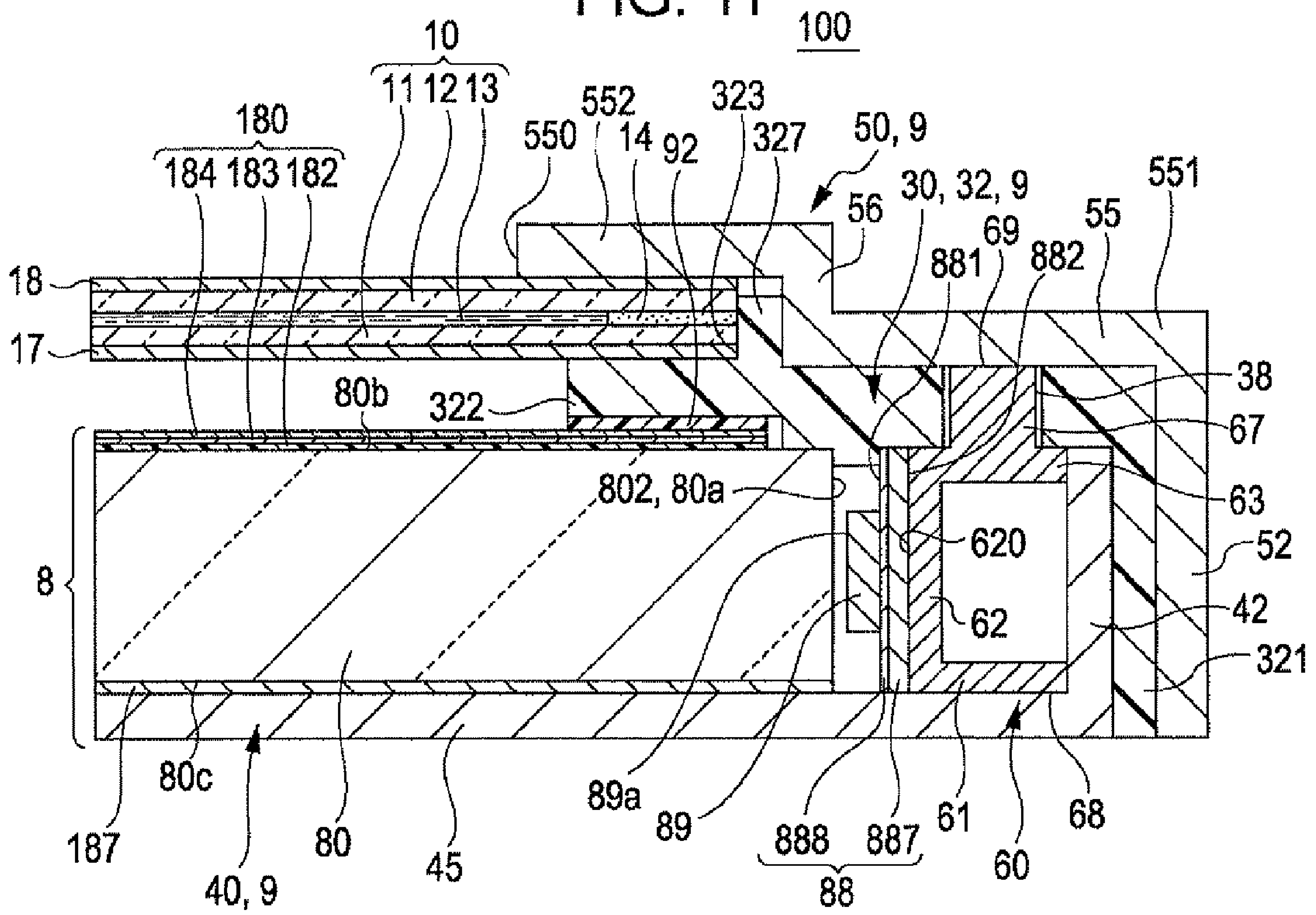
FIG. 11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LIQUID CRYSTAL DISPLAY DEVICE AND ELECTRONIC DEVICE

BACKGROUND

1. Technical Field

The present invention relates to a liquid crystal display device in which a light guide plate, a light emitting element as a light source, and a liquid crystal panel are supported by a frame, and to an electronic device equipped with the liquid crystal display device.

2. Related Art

A liquid crystal display device, equipped with a transmissive liquid crystal panel, includes an illuminating device in which light emitting elements are arranged along side surfaces, designated as light incident portions, of a light guide plate, and a liquid crystal panel is arranged over an outgoing light surface of the light guide plate so as to overlap the light emitting element. Furthermore, the light guide plate, the light emitting elements, and the liquid crystal panel are supported between a first metal frame provided in the opposite direction to the direction in which display light is emitted, and a second metal frame provided in a direction in which the display light is emitted.

When the light emitting elements turn on and generate heat, a change in the amount of emitted light and a decrease in the life of the light emitting element occur. Therefore, a configuration is proposed in which a substrate on which light emitting elements are mounted is arranged so as to overlap the first metal frame, and thus the heat generated in the light emitting elements is dissipated through the substrate and the first metal frame (refer to JP-A-2007-207615).

However, because a large number of light emitting elements are provided in a large-sized liquid crystal display device used in an electronic device such as a liquid crystal television, the configuration described in JP-A-2007-207615 has a problem in that the heat generated in the light emitting elements cannot be sufficiently dissipated. On the other hand, because elements are densely provided in a small-sized liquid crystal display device used in an electronic device such as a portable telephone, there is also a problem in that the heat generated in the light emitting elements cannot be sufficiently dissipated.

Furthermore, in the liquid crystal display device, a resin frame is frequently arranged between a first metal frame and a second metal frame, for example, in order to position each of elements easily and precisely. This causes a problem in that the heat is easy to accumulate in the frame.

SUMMARY

An advantage of some aspects of the invention is to provide a liquid crystal display device capable of holding a light guide plate, light emitting elements, and a liquid crystal panel in place with first and second metal frames, and at the same time preventing light emitting elements from increasing in temperature, and an electronic device equipped with the liquid crystal display device.

According to an aspect of the invention, a liquid crystal display device includes a liquid crystal panel; a light guide plate having a main surface through which light is emitted to the liquid crystal panel, and a plurality of side surfaces, provided on one side of the liquid crystal panel; a plurality of light emitting elements arranged along at least one side surface among the plurality of side surfaces of the light guide plate and each of the plurality of the light emitting elements having a light emitting surface facing the side

surface, designated as a light incident portion; a light source substrate having a mounting surface on which the plurality of the light emitting elements are mounted; a light source support member made of metal with a plurality of surfaces, including a substrate support plate portion supporting the light source substrate, with the substrate support plate portion coming into contact with a rear surface of the mounting surface, with the plurality of surfaces including a first surface and a second surface different from the first surface; and a metal frame accommodating the liquid crystal panel and the light guide plate, and including a first contact portion that comes into contact with the first surface and a second contact portion that comes into contact with the second surface.

In the aspect of the invention, the first contact portion and the second contact portion of the metal frame may be disposed on inside surface of the metal frame that is accommodating the liquid crystal panel and the light guide plate.

Because of this, heat generated in the plurality of the light emitting elements is transferred to the light source support member made of metal through the light source substrate and thereafter is dissipated to the metal frame through the first contact portion and the second contact portion within the metal frame. Because of this, in the aspect of the invention, the heat generated in the light emitting elements may be dissipated using at least two routes, and thus the heat generated in the light emitting elements may be dissipated more efficiently. Therefore, the light emitting elements may be prevented from increasing in temperature.

In the aspect of the invention, the first surface and the second surface of the light source support member may be arranged so as to adjoin each other. Furthermore, the plurality of surfaces of the light source support member may include a third surface that is arranged between the first surface and the second surface of the light source support member, so as to face the light incident portion of the light guide plate.

Because of this, two heat transfer routes may be provided; one heat transfer route of the first surface and the other heat transfer route of the second surface. The first surface and the second surface are arranged so as to be separated from each other in opposite directions, that is, both in a direction of the visual recognition of the liquid crystal display device and in a direction of a rear surface of the liquid crystal display device, and thus the heat generated in the plurality of the light emitting elements may be dissipated more efficiently. Therefore, the light emitting elements may be prevented from increasing in temperature.

According to another aspect of the invention, a liquid crystal display device includes a first metal frame including a bottom plate; a light guide plate having a main surface and a plurality of side surfaces, arranged such that the main surface overlaps the bottom plate of the first metal frame; a plurality of light emitting elements arranged along at least one side surface among the plurality of side surfaces of the light guide plate and each of the plurality of the light emitting elements having a light emitting surface facing the side surface, designated as a light incident portion; a light source substrate having a mounting surface on which the plurality of the light emitting elements are mounted; a light source support member made of metal including a substrate support plate portion supporting the light source substrate, with the substrate support plate portion coming into contact with a rear surface of the mounting surface; a liquid crystal panel disposing in an opposite direction to a direction in which the first metal frame is positioned, with respect to the light guide plate; and a second metal frame including a front plate covering an peripheral area of the liquid crystal panel, the light source support member may have a first contact surface that comes into contact with the first metal frame and a second contact surface that comes into contact with the second metal frame.

In the aspect of the invention, the surface (the rear surface), opposite to the mounting surface, of the light source substrate on which the plurality of the light emitting elements are mounted, may come into contact with the light source support member made of metal, and the light source support member may have the first contact surface that comes into contact with the first metal frame and the second contact surface that comes into contact with the second metal frame. Because of this, the heat generated in the light emitting elements may be transferred to the light source support member made of metal through the light source substrate, and thereafter may be dissipated to the first metal frame through the first contact surface and at the same time to the second metal frame through the second contact surface. Because of this, in the aspect of the invention, the heat generated in the light emitting elements may be dissipated using at least two routes, and thus the heat generated in the light emitting elements may be dissipated more efficiently. Therefore, the light emitting elements may be prevented from increasing in temperature.

In the aspect of the invention, a resin frame which includes a plate-shaped support portion to interpose the light guide plate between the bottom plate of the first metal frame and the plate-shaped support portion of the resin frame, and to interpose the liquid crystal panel between the plate-shaped support portion of the resin frame and the second metal frame may be further included, the light incident portion of the light guide plate may be arranged between the second contact surface of the light source support member and the plate-shaped support portions, in a plane view from a normal direction of the main surface.

In this configuration, even in a case where the resin frame is used, the light source support member and the second metal frame may easily come into surface contact with each other.

In the aspect of the invention, the resin frame may be provided further to an inside than the light source support member, with respect to an in-plane direction of the light guide plate in the plane view from the normal direction of the main surface.

In this configuration, even in a case where the resin frame is used, the light source support member and the second metal frame may easily come into surface contact with each other.

In the aspect of the invention, the substrate support plate portion may face the light incident portion. Furthermore, the light source support member may include: a first plate that bends from an end portion of the substrate support plate portion, which is positioned in a direction of the bottom plate of the first metal frame, so as to form the first contact surface and overlap the bottom plate; and a second plate that bends from an end portion of the substrate support plate portion, which is positioned in a direction of the front plate of the second metal frame, so as to form the second contact surface and overlap the front plate.

In this case, the first plate may form from the substrate support plate portion both in a direction in which the light guide plate is positioned, and in the opposite direction to the direction in which the light guide plate is positioned.

In this configuration, because the first contact surface may increase in area, the heat generated in the plurality of the light emitting elements may be dissipated to the first metal frame more efficiently.

In the aspect of the invention, the second plate may form from the substrate support plate portion both in a direction in which the light guide plate is positioned, and in the opposite direction to the direction in which the light guide plate is positioned.

In this configuration, because the second contact surface may increase in area, the heat generated in the plurality of the light emitting elements may be dissipated to the second metal frame more efficiently.

In the aspect of the invention, a planar direction of the mounting surface may intersect a planar direction of the light incident portion, the second metal frame may include a side plate extending from an edge of the front plate toward the first metal frame, the light source support member may be arranged such that at least a part of the substrate support plate portion overlap the bottom plate of the first metal frame serving as the first contact surface, and the light source support member may include a first plate that bends from an end portion of the substrate support plate portion, which is positioned in the opposite direction to the direction in which the light guide plate is arranged, such that at least a part of the first plate overlap the side plate of the second metal frame serving as the second contact surface.

In this configuration, even though the mounting surface of the light source substrate is perpendicular to the light incident portion, the heat generated in the plurality of the light emitting elements may be dissipated to the first metal frame and the second metal frame.

In the aspect of the invention, the light source support member may further include a second plate that bends from a tip of the first plate in a direction in which the light guide plate is positioned, such that at least a part of the second plate and at least a part of first plate include the second contact surface.

In this configuration, because the second contact surface may increase in area, the heat generated in the plurality of the light emitting elements may be dissipated to the second metal frame more efficiently.

In the aspect of the invention, a resin frame may be further provided which includes a plate-shaped support portion to interpose the light guide plate between the bottom plate of the first metal frame and the plate-shaped support portion, the resin frame may include an opening in an area of the resin frame interposed between the light source support member and the second metal frame, and the second contact surface may be a portion of the light source support member which protrudes into the opening and comes into contact with the second metal frame.

In this configuration, even though the resin frame is interposed between the light source support member and the second metal frame, the heat generated in the plurality of the light emitting elements may be dissipated to the first metal frame and the second metal frame.

The liquid crystal display device according to the aspect of the invention is used in an electronic device such as a liquid crystal television.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

FIGS. **1**A and **1**B are explanatory views of a liquid crystal television (an electronic device) equipped with a liquid crystal display device according to a first embodiment of an aspect of the invention.

FIGS. **2**A and **2**B are explanatory views of the overall configuration of the liquid crystal display device according to the first embodiment of the aspect of the invention.

FIG. **3** is an exploded perspective view illustrating that the liquid crystal display device according to the first embodiment of the aspect of the invention is exploded to a component level.

FIG. **4** is a cross-sectional view of the liquid crystal display device according to the first embodiment of the aspect of the invention, taken along line IV-IV in FIG. **1**A.

FIG. **5** is a cross-sectional view of the liquid crystal display device according to a second embodiment of an aspect of the invention, taken along line V-V in FIG. **1**A.

FIG. **6** is a cross-sectional view of the liquid crystal display device according to a third embodiment of an aspect of the invention, taken along line VI-VI in FIG. **1**A.

FIG. **7** is a cross-sectional view of the liquid crystal display device according to a fourth embodiment of an aspect of the invention, taken along line VII-VII in FIG. **1**A.

FIG. **8** is a cross-sectional view of the liquid crystal display device according to a fifth embodiment of an aspect of the invention, taken along line VIII-VIII in FIG. **1**A.

FIG. **9** is a cross-sectional view of the liquid crystal display device according to a sixth embodiment of an aspect of the invention, taken along line IX-IX in FIG. **1**A.

FIG. **10** is a cross-sectional view of the liquid crystal display device according to a seventh embodiment of an aspect of the invention, taken along line X-X in FIG. **1**A.

FIG. **11** is a cross-sectional view of the liquid crystal display device according to an eighth embodiment of an aspect of the invention, taken along line XI-XI in FIG. **1**A.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

Referring to the drawings, the embodiment is described in which an aspect of the invention is applied to a liquid crystal display device for a liquid crystal television. In the drawings that are referred to in the following description, layers and members are on different scales so as to enlarge them to an easily recognizable level. Furthermore, in the following description, one direction of the intersecting directions in the in-plane directions of a light guide plate and a liquid crystal panel is defined as the X-axis direction (the direction in which long sides of the light guide plate and the liquid crystal panel (a display panel) extend, as shown in the drawings). The other direction is defined as the Y-axis direction (the direction in which short sides of the light guide plate and the liquid crystal panel extend, as shown in the drawings). A direction intersecting the X-axis and Y-axis directions is defined as the Z-axis direction (the direction in which the light guide plate and the display panel are laminated, as shown in the drawings). In the drawings that are referred to in the following description, one pointer of the X-axis direction is defined as an X**1** pointer, and the other pointer as an X**2** pointer. One pointer (direction in which a protruding portion of a liquid crystal panel is arranged) of the Y-axis direction is defined as an Y**1** pointer, and the other opposite to the one pointer as an Y**2** pointer. One pointer (direction opposite to a rear surface of the light guide plate) is defined as a Z**1** pointer (a lower pointer) of the Z-axis direction, and the other pointer, as opposite to the one pointer (the side to which illumination light and display light are emitted) to a Z**2** pointer (an upper pointer).

First Embodiment of Aspect of the Invention

Whole Configuration

FIGS. **1**A and **1**B are explanatory views of a liquid crystal television (an electronic device) equipped with a liquid crystal display device according to a first embodiment of an aspect of the invention. FIG. **1**A is an explanatory view schematically illustrating an external appearance of the liquid crystal television, and FIG. **1**B is a block diagram illustrating an electric configuration of the liquid crystal display device.

As shown in FIG. **1**A, an electronic device **2000** is the liquid crystal television, and includes a liquid crystal display device **100** and a frame **2010** for the television. The liquid crystal display device **100** includes a liquid crystal panel **10** (a display panel), which is described below, an image signal supply unit **270** outputting an image signal to the liquid crystal panel **10**, and an illuminating device **8** supplying illumination light to the liquid crystal panel **10**. Furthermore, the liquid crystal display device **100** includes a scan line drive circuit **104** driving scan lines that extend in the X-axis direction in the liquid crystal panel **10**, and a data line drive circuit **101** driving data lines that extend in the Y-axis direction in the liquid crystal panel **10**. Both of the scan line drive circuit **104** and the data line drive circuit **101** may be configured by being built into the liquid crystal panel **10**. Furthermore, one of the scan line drive circuit **104** and the data line drive circuit **101** may be configured by being built into the liquid crystal panel **10**, and the other may be configured by being built into a drive IC mounted on the liquid crystal panel **10** in a COG manner. Furthermore, one of the scan line drive circuit **104** and the data line drive circuit **101** may be configured by being built into the liquid crystal panel **10**, and the other may be configured by being built into the drive IC mounted on a circuit board electrically connected to the liquid crystal panel **10**. In addition, both of the scan line drive circuit **104** and the data line drive circuit **101** may be configured by being built into the drive IC that is independent of the liquid crystal panel **10**.

In the first embodiment, the illuminating device **8** includes a light guide plate **80** arranged so as to overlap the liquid crystal panel **10**, a plurality of light emitting elements **89** arranged along a side surface, designated as a light incident portion **80***a*, of side surfaces of the light guide plate **80**, a source substrate **88** on which the plurality of light emitting elements **89** are mounted, and a light source drive unit **280** driving emitting elements **89**. In the first embodiment, the liquid crystal panel **10** has the shape of a rectangle with four sides **10***a*, **10***b*, **10***c*, and **10***d*. Of the sides **10***a*, **10***b*, **10***c*, and **10***d*, the side **10***a* is the longest one positioned in the one pointer Y**1** of the Y-axis direction. The side **10***b* is the longest one positioned in the other pointer Y**2** of the Y-axis direction. The side **10***c* is the shortest one positioned in the one pointer X**1** of the X-axis direction. The side **10***d* is the shortest one positioned in the other pointer X**2** of the X-axis direction. To match this shape, the light guide plate **80** has four side surfaces **801**, **802**, **803**, and **804** as well. Of the surfaces **801** to **804**, the side surface **801** is positioned on the longest side in the one pointer Y**1** of the Y-axis direction. The side surface **802** is positioned on the longest side in the other pointer Y**2** of the Y-axis direction. The side surface **803** is positioned on the shortest side in the one pointer X**1** of the X-axis direction. The side surface **804** is positioned on the shortest side in the other pointer X**2** of the X-axis direction.

In the first embodiment, of the four side surfaces **801**, **802**, **803**, and **804** of the light guide plate **80**, the two side surfaces **801** and **802**, which are opposite to each other in a direction of the short side (in the Y-axis direction) serve as a light incident portion **80***a*. Because of this, the light emitting elements **89** are arranged along the two side surfaces **801** and **802** (light incident portions **80***a*) of the light guide plate **80**, respectively, and the light source substrates **88** extend along the two side surfaces **801** and **802** (light incident portions **80***a*) of the light guide plate **80**, respectively.

Specific Configuration of Liquid Crystal Display Device **100**

FIGS. **2**A and **2**B are explanatory views of the overall configuration of the liquid crystal display device **100** according to the aspect of the first embodiment. FIG. **2**A is a perspective view of the liquid crystal display device **100**. FIG. **2**B is an exploded perspective view of the liquid crystal display device **100**. FIG. **3** is an exploded perspective view illustrating that the liquid crystal display device **100** according to the first embodiment of the aspect of the invention is exploded to a component level. FIG. **4** is a cross-sectional view of the liquid crystal display device **100** according to the first embodiment of the aspect of the invention, taken along line IV-IV in FIG. **1**A.

As shown in FIGS. **2**A, **2**B, **3** and **4**, the liquid crystal display device **100** according to the first embodiment, largely includes the illuminating device **8**, which is also known as a backlight device, and the transmissive liquid crystal panel **10** arranged so as to overlap an upper surface of the illuminating device **8**. In the liquid crystal display device **100**, the illuminating device **8** includes a main frame **9**. In the first embodiment, the main frame **9** includes a first metal frame **40** (a lower frame), arranged so as to cover a rear surface of the light guide plate **80** from downward (in the one pointer Z**1** of the Z-axis direction), a resin frame **30**, holding a peripheral area of the liquid crystal panel **10** in place, and at the same time holding the illuminating device **8** in place by surrounding the illuminating device **8**, from over the first metal frame **40**, and a second metal frame **50** (an upper frame) arranged above the resin frame **30** (in the other pointer Z**2** of the Z-axis direction).

The resin frame **30** holds the edge of the liquid crystal panel **10** and at the same time has the shape of a rectangle surrounding the edge of the liquid crystal panel **10**. In the first embodiment, the resin frame **30** includes four frame plates **31**, **32**, **33**, and **34** corresponding to the four sides of the liquid crystal panel **10**, respectively. In the first embodiment, the resin frame **30** is black in color, and functions as a light absorbing member to prevent light leakage within the illuminating device **8**. The frame plates **31**, **32**, **33**, and **34** include plate-shaped support portions **312**, **322**, **332**, and **342**, and ridges **317**, **327**, **337**, and **347**, respectively. The ridges **317**, **327**, **337**, and **347** protrude forward (in a direction of emitting illumination light/in the other pointer Z**2** of the Z-axis direction) from the plate-shaped support portions **312**, **322**, **332**, and **342**, respectively. Because of this, within the frame plates **31**, **32**, **33**, and **34**, corner portions **313**, **323**, **333**, and **343** are formed by the plate-shaped support portions **312**, **322**, **332**, and **342** and the ridges **317**, **327**, **337**, and **347**. The corner portions **313**, **323**, **333**, and **343** hold the liquid crystal panel **10** in place. Furthermore, the light guide plate **80** of the illuminating device **8** and the light emitting element **89** are arranged in a direction of the rear surfaces of the plate-shaped support portions **312**, **322**, **332**, and **342** (in a direction opposite to the direction in which the illumination light is emitted/in the one pointer Z**1** of the Z-axis direction). Lower ridge **325** is also shown.

The first metal frame **40** is formed by performing, for example, a pressing operation on a thin metal plate, such as a SUS plate. The first metal frame **40** includes a bottom plate **45**, and four side plates **41**, **42**, **43**, and **44** that protrude forward from an edge of the bottom plate **45**. The first metal frame **40** is rectangular, and box-shaped with an opening in an upward direction.

The second metal frame **50**, like the first metal frame **40**, is also formed by performing, for example, the pressing operation on the thin metal plate, such as the SUS plate. The second metal frame **50** includes a front plate **55** (an edge plate), which is rectangular, and four side plates **51**, **52**, **53**, and **54** that protrude backward from an edge of the bottom plate **55** (in a direction of the first metal frame **40**), respectively. The side plates **51**, **52**, **53**, and **54** overlap the outer sides of the side plates **41**, **42**, **43**, and **44** of the first metal frame **40**, respectively.

A step portion **56** is formed in the front plate **55**. A first flat plate **551** and a second flat plate **552** are formed outside and inside, respectively, with the step portion **56** in between, in the front plate **55**. The first flat plate **551** is positioned at a lower height than the second flat plate **552** (in a direction in which the light guide plate **80** is positioned/in the one pointer of the Z-axis direction). The side plates **51**, **52**, **53**, and **54** protrude backward from an edge of the first flat plate **551**. In the first embodiment, in the front plate **55**, a rectangular window **550** through which to emit light emitted from the liquid crystal panel **10** is formed in the second flat plate **552** positioned further to the inside than the step portion **56**. Because of this, the second metal frame **50** has the shape of a rectangle, and the front plate **55** covers the whole edge of the display light emitting portion of the liquid crystal panel **10**.

The second metal frame **50** with this configuration, the resin frame **30**, and the first metal frame **40** are combined using, for example, a screw (not shown). Thus, the liquid crystal panel **10** and the illuminating device **8** are held in place within an assembly of the second metal frame **50**, the resin frame **30**, and the first metal frame **40**. More specifically, an end portion of the liquid crystal panel **10** is interposed between the plate-shaped support portions **312**, **322**, **332**, and **342** of the resin frame **30** and the portion of the front plate **55** of the second metal frame **50** which is positioned further to the inside than the step portion **56**.

Furthermore, a reflective sheet **187**, the light guide plate **80**, and an edge of an optical sheet **180** (a diffusion sheet **182**, and prism sheets **183** and **184**) are interposed between the plate-shaped support portions **312**, **322**, **332**, and **342** of the resin frame **30** and the bottom plate **45** of the first metal frame **40**. Because of this, the edge of the optical sheet **180** is interposed between the plate-shaped support portions **312**, **322**, **332**, and **342** of the resin frame **30** and the light guide plate **80**. At this point, the front plate **55** of the second metal frame **50** is in a position to overlap an edge of the light guide plate **80**. Because of this, the light guide plate **80** and the reflective sheet **187** are interposed between the plate-shaped support portions **312**, **322**, **332**, and **342** of the resin frame **30** and the bottom plate **45** of the first metal frame **40**, and at the same time are interposed between the front plate **55** of the second metal frame **50** and the bottom plate **45** of the first metal frame **40**.

Furthermore, a flexible sheet **92** is affixed to the bottom of the plate-shaped support portions **312**, **322**, **332**, and **342** of the resin frame **30**. Therefore, when assembling the liquid crystal display device **100**, the illuminating device **8** is supported with the help of the flexible sheet **92**. Furthermore, when assembling the liquid crystal display device **100**, the optical sheet **180** of the illuminating device **8** (the diffusion sheet **182**, the prism sheets **183** and **184** and others) is pressed so as to enable the flexible sheet **92** to prevent a lifting phenomenon and a position slippage.

Configuration of Liquid Crystal Panel **10**

As shown in FIGS. **2**A, **2**B, **3**, and **4**, the liquid crystal panel **10** is quadrilateral and flat. The liquid crystal panel **10** includes an element substrate **11** on which pixel electrodes (not shown) are formed, an opposite substrate **12** facing the element substrate **11** with a given space between the element substrate **11** and the opposite substrate **12**, and a sealant **14**, in the rectangular shape, attaching the element substrate **11** and the opposite substrate **12** to each other. A liquid crystal layer **13** is held in place within an area enclosed by the sealant **14** in the liquid crystal panel **10**. The element substrate **11** and the opposite substrate **12** are made from such a translucent substrate as a glass substrate. In the element substrate **11**, a plurality of scan lines (not shown) extend in the X-axis direction, and a plurality of data lines (not shown) extend in the Y-axis direction. A switching element (not shown) and a pixel electrode are provided at a position corresponding to a point where the scan line and the data line intersect.

In the first embodiment, the opposite substrate **12** is arranged in a direction of emitting display light, and the element substrate **11** is arranged in a direction of the illuminating device **8**. Furthermore, on a surface of the opposite substrate **12**, facing the element substrate **11**, a frame layer (not shown) made from a light shielding layer in the rectangular frame shape is formed along an inner edge of the four lines of the sealant **14**. An area defined by an inner edge of the frame layer is an image display area **100***a*. In addition, an inner edge of the front plate **55** of the second metal frame **50** are positioned with respect with the middle of the width direction of the frame layer, and thus the window **550** of the second metal frame **50** overlaps the image display area **100***a* and an inner edge portion of the frame layer.

The liquid crystal panel **10** is configured as a liquid crystal panel that is a type of TN (Twisted Nematic), a type of ECB (Electrically Controlled Birefringence), or a type of VAN (Vertical Aligned Nematic). The pixel electrodes are formed on the element substrate **11**, and common electrodes (not shown) are formed in the opposite substrate **12**. In addition, in a case where the liquid crystal panel **10** is a type of IPS (In Plane Switching) or a type of FFS (Fringe Field Switching), the common electrodes are formed in the element substrate **11**. Furthermore, the element substrate **11** may be arranged in a direction of emitting the display light toward the opposite substrate **12**. An upper polarizing **18** is arranged on an upper surface of the liquid crystal panel **10** so as to overlap the liquid crystal panel **10**, and a lower polarizing **17** is arranged between a lower surface of the liquid crystal panel **10** and the illuminating device **8**.

In the first embodiment, the element substrate **11** is larger in size than the opposite substrate **12**. Because of this, the element substrate **11** includes a protrusion portion **110** that protrudes from below an edge of the opposite substrate **12** in the one pointer Y**1** of the Y-axis direction. A plurality of flexible wiring substrates **200** is connected to an upper surface of the protrusion portion **110**. The flexible wiring substrate **200** is connected to a circuit substrate **250**, made from a rigid substrate. A control IC (not shown) making up the image signal supply unit **270** as described above referring to FIGS. **1**A and **1**B, and a light source drive IC (not shown) making up the light source drive unit **280** are mounted on the circuit substrate **250**.

Configuration of Illuminating Device **8**

As shown in FIGS. **3** and **4**, the illuminating device **8** includes the light guide plate **80** that is arranged so as to overlap a rear surface of the liquid crystal panel **10**, and the plurality of light emitting elements **89** that are arranged toward a light emitting surface **89***a*, facing an area in the light incident portion **80***a* which ranges from one periphery of the light incident portion **80***a* (from the one pointer X**1** of the X-axis direction) to the other periphery of the light incident portion **80***a* (to the other pointer X**2** of the X-axis direction). In the first embodiment, the plurality of light emitting elements **89** are mounted on a mounting surface **881** of the light source substrate **88** that extends along the light incident portion **80***a* in the X-axis direction, and the light source substrate **88** are arranged in such a manner that the mounting surface **881** may face the light incident portion **80***a* of the light guide plate **80**. The light emitting element **89** is an LED (Light Emitting Diode) emitting white light, and emits the light-source light as diverging light.

In the first embodiment, in the illuminating device **8**, the side surfaces **801** and **802** of the side surfaces **801**, **802**, **803**, and **804** of the light guide plate **80** are opposite to each other in the Y-axis direction. These two side surfaces **801** and **802** serve as the light incident portion **80***a*. Because of this, the plurality of light emitting elements **98** face a light emitting surface **89***a* toward two of the light incident portions **80***a* (the side surface **801**, **802**) of the light guide plate **80** and are arranged toward each of two of the light incident portions **80***a* (the side surface **801**, **802**) from one side end to the other side end. Furthermore, two of the light source substrates **88** extend along two of the light incident portions **80***a* (the side surfaces **801** and **802**), respectively. The plurality of light emitting elements **89** is mounted on each mounting surfaces **881** of the two of the light source substrates **88**.

In the first embodiment, the light guide plate **80** is a translucent resin plate, made from an acrylic resin, a polymethyl styrene resin, or a polycarbonate resin. The reflective sheet **187** is arranged between a rear surface **80***c* of the light guide plate **80** (an opposite surface of the light guide plate **80** to an outgoing light surface **80***b*/an opposite surface) and the bottom plate **45** of the first metal frame **40**, so as to overlap the rear surface **80***c* and the bottom plate **45**. The resin plate used in the light guide plate **80** is formed, for example, using an extrusion molding method or an injection molding method.

Furthermore, the optical sheet **180**, such as the diffusion sheet **182** and the prism sheets **183** and **184**, is arranged between an upper surface (the outgoing light surface **80***b*) of light guide plate **80** and the liquid crystal panel **10**, so as to overlap the upper surface of light guide plate **80** (the outgoing light surface **80***b*) and the liquid crystal panel **10**. The diffusion sheet **182** is made from a sheet having a coating layer formed by dispersing silica particles into a translucent resin, such as an acrylic resin or a polycarbonate resin. In the first embodiment, the two prism sheets **183** and **184** are arranged in such a manner that ridge lines of the prism sheets **183** and **184** may intersect. Because of this, the illumination light emitted from the outgoing light surface **80***b* of the light guide plate **80** are dispersed in all directions by the diffusion sheet **182**, and then is given a directivity that creates a result of retaining a peak in the forward direction of the liquid crystal panel **10**, by the two prism sheets **183** and **184**.

Furthermore, in the light guide plate **80**, a plurality of grooves (not shown), which is made from linear fine concavities extending in the X-axis direction, are formed as a spread pattern in a rear surface **80***c* on which the reflective sheet **187** is positioned. In the first embodiment, the further the groove runs away from the light emitting element **89**, the higher the density of the grooves is. Because of this, the intensity distribution of the illumination light emitted from the light guide plate **80** is uniform, regardless of the distance from the light emitting element **89**.

In the first embodiment, the light source substrate **88** is arranged in such a manner that a mounting surface **881** on which the light emitting elements **89** are mounted may face the light incident portion **80***a* of the light guide plate **80**. Furthermore, the light source substrate **88** has a configuration in which a wiring pattern and a land, along with an insulation layer, are provided on one surface (the one surface in a direction of the mounting surface **881**) of a metal plate **887** (a support plate) that extends along the light incident portion **80***a*. This configuration is made possible when a flexible wiring substrate **888**, on which a resin base material layer, a wiring pattern, and an insulating protective layer are laminated in this order, is attached to the mounting surface **881** of the metal plate **887**. Therefore, the land, on which the wiring pattern and chips of the light emitting elements **89** are mounted, is electrically insulated from the metal plate **887**. In the first embodiment, the metal plate **887** is made from an aluminum plate. The metal plate **887** not only provides mechanical strength to the light source substrate **88**, but also serves as a heat-dissipating plate dissipating heat generated from the light emitting element **89**.

A light source support member **60**, which holds the light source substrate **88** in place, is arranged on the other surface **882** of each of the two light source substrates **88**. At this point, in the second metal frame **50**, the front plate **55** protrudes further to the outside than the resin frame **30**, with respect to the in-plane direction of the light guide plate **80**. Furthermore, the resin frame **30** is arranged further to the inside than the light source support member **60**, with respect of the in-plane direction of the light guide plate **80**. Because of this, the light source support member **60** is arranged between the bottom plate **45** of the first metal frame **40** and the front plate **55** of the second metal frame **50**. In the first embodiment, the light source support member **60** is a bar-shaped metal material that extends along the other surface **882** of the light source substrate **88**, and is made from, for example, aluminum, or iron-series metal.

Configuration of Light Source Support Member **60**

Mainly referring to FIGS. **3** and **4**, a specific configuration of the light source support member **60**, which is provided in a direction in which the side surface **802** of the light guide plate **80** is positioned, and a heat dissipation configuration for the light emitting element **89** are described. Furthermore, in the first embodiment, the light emitting element **89**, the light source substrate **88**, and the light source support member **60** are provided also in a direction of the side surface **801** of the light guide plate **80**, but a description of a peripheral configuration of the side surface **801** is omitted because the side surface **801** is the same as the side surface **802** in peripheral configuration.

As shown in FIGS. **3** and **4**, the light source support member **60** includes a substrate support plate portion **62** that is opposite to the light incident portion **80***a* of the light guide plate **80**. A surface of the substrate support plate portion **62**, which is toward the light guide plate **80**, is defined as a substrate support surface **620**. The other surface **882** of the light source substrate **88** comes into contact with the substrate support surface **620**, so as to overlap the substrate support surface **620**. The light source substrate **88** is fixed to the substrate support plate portion **62**, for example, using a screw. When this is done, the substrate support surface **620** and the other surface **882** of the light source substrate **88** come in contact with each other.

In the first embodiment, as described below, the light source support member **60** includes a first contact surface **68** that comes into contact with the first metal frame **40**, and a second contact surface **69** that comes into contact with the second metal frame **50**. Furthermore, in the first embodiment, in the second metal frame **50**, the front plate **55** protrudes further to the outside than the resin frame **30**, and at the same time the resin frame **30** is arranged further to the inside than the light source support member **60**. Because of this, the second contact surface **69** of the light source support member **60** comes into contact with the second metal frame **50**, in an area where the second contact surface **69** is positioned further to the outside than the resin frame **30**.

More specifically, the light source support member **60** includes a first plate **61** bending from an end portion of the substrate support plate portion **62** that faces the bottom plate **45** of the first metal frame **40**, in the opposite direction to the direction in which the light guide plate **80** is positioned, so as to overlap the bottom plate **45**. The first plate **61** has a first contact surface **68** that comes into contact with the bottom plate **45** of the first metal frame **40**. At this point, an end portion of the first plate **61**, which is positioned in the opposite direction to the direction in which the light guide plate **80** is positioned, comes into contact with a side plate **42** of the first metal frame **40**.

Furthermore, the light source support member **60** includes a second plate **63** bending from the end portion of the substrate support plate portion **62** that faces the front plate **55** of the second metal frame **50**, in the opposite direction to the direction in which the light guide plate **80** is positioned, so as to overlap the front plate **55**. The second plate **63** has a second contact surface **69** that comes into contact with the first flat plate **551**, in the front plate **55** of the second metal frame **50**. At this point, an end portion of the second plate **63**, which is positioned in the opposite direction to the direction in which the light guide plate **80** is positioned, comes into contact with a side plate **42** of the first metal frame **40**.

In this configuration, the first plate **61** and the bottom plate **45** of the first metal frame **40** are connected to each other, for example, using a screw, and thus the light source support member **60** is held in place between the bottom plate **45** of the first metal frame **40** and the front plate **55** of the second metal frame **50**. Furthermore, the second plate **63** and the front plate **55** of the second metal frame **50** are connected to each other, for example, using a screw, and thus the light source support member **60** is held in place between the bottom plate **45** of the first metal frame **40** and the front plate **55** of the second metal frame **50**.

Main Effects of the First Embodiment

As described above, in the liquid crystal display device **100** according to the first embodiment, the light source substrate **88** on which the light emitting elements **89** are mounted is held in place with the other surface **882** coming into contact with substrate support plate portion **62** of the light source support member **60** made of metal. Because of this, the heat generated in the light emitting element **89** is transferred to the light source support member **60** from the light source substrate **88**. At this point, the light source support member **60** has a first contact surface **68** that comes into contact with the first metal frame **40**, and a second contact surface **69** that comes into contact with the second metal frame **50**. Because of this, the heat generated in the light emitting elements **89** is transferred to the light source support member **60** made of metal through the light source substrate **88**. Thereafter, the heat is dissipated to the first metal frame **40** through the first contact surface **68**, and at the same time to the second metal frame **50** through the second contact surface **69**. Because of this, in the first embodiment, the heat generated in the light emitting elements **89** may be dissipated using at least two routes. As a result, even though the light guide plate **80**, the light emitting element **89** and the liquid crystal panel **10** are held in place by the first metal frame **40**, the resin frame **30**, and the second metal frame **50**, the heat generated in the light emitting elements **89** may be dissipated more efficiently. Therefore, the light emitting element **89** may be prevented from increasing in temperature.

Especially in the first embodiment, since the light source substrate **88** includes the metal plate **887** on the other surface **882**, the heat generated in the light emitting elements **89** may be efficiently dissipated to the light source support member **60** made of metal through the metal plate **887**. Therefore, a rise in the temperature of the light emitting elements **89** may be reliably suppressed to be low.

Furthermore, in the light source member **60**, since the end portions of the first plate **61** and the second plate **63** come into with the side plate **42** of the first metal frame **40**, the light source support member **60** (the positions of the light emitting elements **89**) may be arranged with high positional accuracy, and at the same time the heat transferred to the light source support member **60** may be dissipated to the side plate **42** of the first metal frame **40** more efficiently. Therefore, a rise in the temperature of the light emitting elements **89** may be reliably suppressed to be low.

Furthermore, in the first embodiment, the light guide plate **80** and the reflective sheet **187** are interposed between the plate-shaped support portions **312**, **322**, **332**, and **342** of the resin frame **30** and the bottom plate **45** of the first metal frame **40**, and at the same time are interposed between the front plate **55** of the second metal frame **50** and the bottom plate **45** of the first metal frame **40**. Because of this, the light guide plate **80** and the reflective sheet **187** may be held in place in a certain manner, even though the resin frame **30** is arranged further to the inside than the light source support member **60** to retain the second contact surface **69**.

Second Embodiment

FIG. **5** is a cross-sectional view of a liquid crystal display device **100** according to a second embodiment of the invention, taken along line V-V in FIG. **1**A. Furthermore, because a basic configuration of the second embodiment is the same as the first embodiment, common elements are given like reference numerals, and descriptions of the common elements are omitted.

In the first embodiment, since a front plate **55** of a second metal frame **50** is in a position to overlap an end portion of a light guide plate **80**, the light guide plate **80** and a reflective sheet **187** are interposed between the plate-shaped support portions **312**, **322**, **332**, and **342** of a resin frame **30** and a bottom plate **45** of a first metal frame **40**, and at the same time are interposed between a front plate **55** of a second metal frame **50** and the bottom plate **45** of the first metal frame **40**. In contrast, in the second embodiment, as shown in FIG. **5**, the resin frame **30** is provided further to the inside than a light source support member **60**, but the plate-shaped support portion **322** is provided so as to extend beyond a ridge **327**. Because of this, the resin frame **30** overlaps the end portion of the light guide plate **80** and a light source substrate **88**. Therefore, in the second embodiment, the light guide plate **80** and the light source substrate **88** are held in place in a certain manner, even though the resin frame **30** is arranged further to the inside than the light source support member **60** to retain a second contact surface **69**. That is, the light guide plate **80** and a reflective sheet **187** are interposed between the plate-shaped support portion **322** of the resin frame **30** and the bottom plate **45** of the first metal frame **40**, and at the same time even the light source substrate **88** is interposed between the plate-shaped support portion **322** of the resin frame **30** and the bottom plate **45** of the first metal frame **40**.

Furthermore, in the second embodiment, in a rear surface of the plate-shaped support portion **322**, a convexity **36** is provided into between the light guide plate **80** and the light source substrate **88**. Because of this, in the second embodiment, the positioning of the light source substrate **88** and the light source support member **60** may be reliably performed, even though the resin frame **30** is arranged further to the inside than the light source support member **60** to retain a second contact surface **69**. That is, the light source substrate **88** and the light source support member **60** are interposed between the convexity **36** and a side plate **42** of the first metal frame **40**.

In the second embodiment with this configuration, the positioning of the light guide plate **80**, the light source substrate **88** and the light source support member **60** may be reliably performed by the resin frame **30**, even though the resin frame **30** is arranged further to the inside than the light source support member **60** to retain the second contact surface **69**.

Third Embodiment

FIG. **6** is a cross-sectional view of a liquid crystal display device **100** according to a third embodiment of the invention, taken along line VI-VI in FIG. **1**A. Furthermore, because a basic configuration of the third embodiment is the same as the first and second embodiments, common elements are given like reference numerals, and descriptions of the common elements are omitted.

In the first and second embodiments, a step portion **56** is provided on a front plate **55** of a second metal frame **50**. However, in the third embodiment, as shown in FIG. **6**, the front plate **55** is flat without having to provide the step portion **56**. Even in this configuration, a light source support member **60** extends further forward than a resin frame **30**, and has a second contact surface **69** that comes into contact with the front plate **55**.

At this point, the resin frame **30** is provided further to the inside than the light source support member **60**, but a plate-shaped support portion **322** is provided so as to extend to beyond a ridge **327**, as in the second embodiment. Because of this, the resin frame **30** overlaps an end portion of a light guide plate **80** and a light source substrate **88**. Therefore, in the third embodiment, the light guide plate **80** and the light source substrate **88** may be held in place in a certain manner, even though the resin frame **30** is arranged further to the inside than the light source support member **60** to retain a second contact surface **69**. That is, the light guide plate **80** and the reflective sheet **187** are interposed between the plate-shaped support portion **322** of the resin frame **30** and a bottom plate **45** of a first metal frame **40**, and at the same time even a light source substrate **88** is interposed between the plate-shaped support portion **322** of the resin frame **30** and the bottom plate **45** of the first metal frame **40**.

Furthermore, in the third embodiment, in a rear surface of the plate-shaped support portion **322**, a convexity **36** is provided into between the light guide plate **80** and the light source substrate **88**. Because of this, in the third embodiment, the positioning of the light source substrate **88** and the light source support member **60** may be reliably performed, even though the resin frame **30** is arranged further to the inside than the light source support member **60** to retain the second contact surface **69**. That is, the light source substrate **88** and the light source support member **60** are interposed between the convexity **36** and the side plate **42** of the first metal frame **40**.

In addition, in the third embodiment, the light source support member **60** is interposed between the resin frame **30** and the side plate **42** of the first metal frame **40**. Because of this, in the third embodiment, the positioning of the light guide plate **80**, the light source substrate **88** and the light source support member **60** may be reliably performed by the resin frame **30**, even though the resin frame **30** is arranged further to the inside than the light source support member **60** to retain the second contact surface **69**.

Fourth Embodiment

FIG. **7** is a cross-sectional view of a liquid crystal display device **100** according to a fourth embodiment of the invention, taken along line VII-VII in FIG. **1**A. Furthermore, because a basic configuration of the fourth embodiment is the same as the first embodiment, common elements are given like reference numerals, and descriptions of the common elements are omitted.

In the first embodiment, a first plate **61** and a second plate **63** bend from end portions of a substrate support plate portion **62** in the opposite direction to the direction in which the light guide plate **80** is positioned. However, in the fourth embodiment, as shown in FIG. **7**, the first plate **61** bends from the end portions of the substrate support plate portion **62** both in a direction in which the light guide plate **80** is positioned, and in the opposite direction to the direction in which the light guide plate **80** is positioned, and thus has a first contact surface **68** that comes into contact with a bottom plate **45** of a first metal frame **40**. At this point, an end portion of the first plate **61**, which is positioned in the opposite direction to the direction in which the light guide plate **80** is positioned, comes into contact with a side plate **42** of the first metal frame **40**. The end portion of the first plate **61**, which is positioned in a direction to the direction in which the light guide plate **80** is positioned, comes into contact with the light guide plate **80**.

Furthermore, the second plate **63** bends from the end portions of the substrate support plate portion **62** both in a direction in which the light guide plate **80** is positioned, and in the opposite direction to the direction in which the light guide plate **80** is positioned, and thus has a second contact surface **69** that comes into contact with a front plate **55** of a second metal frame **50**. At this point, the end portion of the second plate **63**, which is positioned in the opposite direction to the direction in which the light guide plate **80** is positioned, comes into contact with the side plate **42** of the first metal frame **40**. An end portion of the second plate **63**, which is positioned in a direction to the direction in which the light guide plate **80** is positioned, comes into contact with the light guide plate **80**.

Because of this, in the fourth embodiment, the first contact surface **68** and the second contact surface **69** are large in area, and thus heat dissipation from a light source support member **60** to the first metal frame **40** and the second metal frame **50** may increase. Furthermore, in the fourth embodiment, the positioning of a light source substrate **88** and the light source support member **60** may be reliably performed, since the light source substrate **88** and the light source support member **60** are interposed between the light guide plate **80** and the side plate **42** of the first metal frame **40**, even though a resin frame **30** is arranged further to the inside than the light source support member **60** to retain the second contact surface **69**.

Fifth Embodiment

FIG. **8** is a cross-sectional view of a liquid crystal display device **100** according to a fifth embodiment of the invention, taken along line VIII-VIII in FIG. **1**A. Furthermore, because a basic configuration of the fifth embodiment is the same as the first embodiment, common elements are given like reference numerals, and descriptions of the common elements are omitted.

In the first embodiment, a first plate **61** and a second plate **63** bend from end portions of a substrate support plate portion **62** in the opposite direction to the direction in which the light guide plate **80** is positioned. However, in the fifth embodiment, as shown in FIG. **8**, the first plate **61** bends from the end portion of the substrate support plate portion **62** in a direction in which the light guide plate **80** is positioned, and thus has a first contact surface **68** that comes into contact with a bottom plate **45** of a first metal frame **40**. Furthermore, the substrate support plate portion **62** comes into contact with a side plate **42** of the first metal frame **40**, and thus makes up a portion of the first contact surface **68**. At this point, end portions of the first plate **61**, which is positioned in a direction in which the light guide plate **80** is positioned, comes into contact with the light guide plate **80**.

Furthermore, the second plate **63** bends from the end portion of the substrate support plate portion **62** in a direction in which the light guide plate **80** is positioned, and thus has a second contact surface **69** that comes into contact with a front plate **55** of a second metal frame **50**. At this point, the end portion of the second plate **63**, which is positioned in a direction to the direction in which the light guide plate **80** is positioned, comes into contact with the light guide plate **80**.

Because of this, in the fifth embodiment, the positioning of the light source substrate **88** and the light source support member **60** may be reliably performed, since a light source substrate **88** and a light source support member **60** are interposed between the light guide plate **80** and the side plate **42** of the first metal frame **40**, even though a resin frame **30** is arranged further to the inside than the light source support member **60** to retain the second contact surface **69**.

Furthermore, the first plate **61** and the substrate support plate portion **62** makes up the first contact surface **68**, resulting in the first contact surface **68** being large in area. Because of this, heat dissipation from the light source support member **60** to the first metal frame **40** may increase.

Sixth Embodiment

FIG. **9** is a cross-sectional view of a liquid crystal display device **100** according to a sixth embodiment of an aspect of the invention, taken along line IX-IX in FIG. **1**A. Furthermore, because a basic configuration of the sixth embodiment is the same as the first embodiment, common elements are given like reference numerals, and descriptions of the common elements are omitted.

In the first to fifth embodiments, a mounting surface **881** of a light source substrate **88** is opposite to a light incident portion **80***a* of a light guide plate **80**. However, in the sixth embodiment, as shown in FIG. **9**, the mounting surface **881** of the light source substrate **88** is perpendicular to the light incident portion **80***a* of the light guide plate **80**. Because of this, a light source support member **60** has a substrate support plate portion **64** perpendicular to the light incident portion **80***a* of the light guide plate **80**. At the same time the substrate support plate portion **64** is arranged so as to overlap a bottom plate **45** of a first metal frame **40**. As a result, a surface of one end portion of the substrate support plate portion **64** becomes a first contact surface **68** and at the same time becomes a substrate support surface **640** that comes in contact with a light source substrate **88**, thereby supporting the light source substrate **88**.

Furthermore, in the sixth embodiment, the first metal frame **40** does not include a side plate **42**. Because of this, the light source support member **60** includes a plate **65** (a first plate) bending from the end portion of the substrate support plate portion **64**, which is opposite to the direction in which the light guide plate **80** is positioned, so as to overlap a side plate **52** of a second metal frame **50**. As a result, the plate **65** (a first plate) has a second contact surface **69**.

Because of this, in the sixth embodiment, even when a mounting surface **881** of the light source substrate **88** is perpendicular to the light incident portion **80***a*, heat generated in light emitting elements **89** may be dissipated to the first metal frame **40** and the second metal frame **50** through the first contact surface **68** and the second contact surface **69** of the light source support member **60**, respectively.

Seventh Embodiment

FIG. **10** is a cross-sectional view of a liquid crystal display device **100** according to a seventh embodiment of the invention, taken along line X-X in FIG. **1**A. Furthermore, because a basic configuration of the seventh embodiment is the same as the first embodiment, common elements are given like reference numerals, and descriptions of the common elements are omitted.

In the sixth embodiment as described above, a second contact surface **69** is formed by a plate **65**. However, in the seventh embodiment, as shown in FIG. **10**, a plate **66** (a second plate) is additionally provided which protrudes from a tip of a plate **65** (a first plate) in a direction in which a light guide plate **80** is positioned, so as to overlap a front plate **55** of a second metal frame **50** and make up the second contact surface **69**. In this configuration, because a second contact surface **69** is made larger in area, heat generated in light emitting elements **89** may be dissipated to the second metal frame **50** efficiently.

At this point, the tip of the plate **66** comes into contact with the light guide plate **80**. Because of this, a light source substrate **88** and a light source support member **60** are interposed between the light guide plate **80** and a side plate **52** of the second metal frame **50**. Because of this, the positioning of the light source substrate **88** and the light source support member **60** may be reliably performed, even though a resin frame **30** is arranged further to the inside than the light source support member **60** to retain the second contact surface **69**.

Eighth Embodiment

FIG. **11** is a cross-sectional view of a liquid crystal display device **100** according to an eighth embodiment of the invention, taken along line XI-XI in FIG. **1**A. Furthermore, because a basic configuration of the eighth embodiment is the same as the first and second embodiments, common elements are given like reference numerals, and descriptions of the common elements are omitted.

In the first to seventh embodiments, a resin frame **30** is arranged further to the inside that a light source support member **60**. However, in the eighth embodiment, as shown in FIG. **11**, a plate-shaped support portion **322** of the resin frame **30** is provided so as to extend to beyond a ridge **327**. Furthermore, the resin frame **30** includes a side plate **321** which extends from an outer edge of the ridge **327** toward a first metal frame **40**. Because of this, the resin frame **30** is interposed between the light source support member **60** and a second metal frame **50**.

At this point, in the resin frame **30**, an opening **38** is formed in a plate-shaped support portion **322** that is interposed between a second plate **63** of a light source support member **60** and a front plate **55** of a second metal frame **50**. Furthermore, a convexity **67** is formed in the light source support member **60**. The convexity **67** protrudes from the second plate **63** into the opening **38**, and then comes into contact with a front plate **55** of the second metal frame **50**. A second contact surface **69** is formed by a portion of the convexity **67**, which comes into contact with the front plate **55**. Therefore, even in the eighth embodiment, as in the first to seventh embodiments, heat generated in light emitting elements **89** may be dissipated to a light source substrate **88** and then to the light source support member **60**. Thereafter, the heat may be dissipated from a first contact surface **68** and the second contact surface **69**, to the first metal frame **40** and the second metal frame **50**, respectively.

Furthermore, in the eighth embodiment, the second contact surface **69** is formed by the convexity **67** provided in the light source support member **60**, but may be formed by a convexity provided, in a direction of the second metal frame **50**, in such a manner that the convexity may protrude from the front plate **55** into the opening **38** and then come into contact with the second plate **63** of the light source support member **60**.

Other Embodiments

In the embodiments described above, both of a side surface **801** of a light guide plate **80** and a side surface **802** of the light guide plate **80** are used as a light incident portion **80***a*. However, the invention may be applied to a liquid crystal display device **100** in which only one of side surfaces **801** and **802** is used as the light incident portion **80***a*.

In the embodiments described above, what is made of the metal plate **887** and the flexible wiring substrate **888** laminated on the metal plate **887** is used as the light source substrate **88**. However, the invention may be applied to a case where the flexible wiring substrate **888** or the rigid substrate is independently used as the light source.

Example of Equipping Electronic Device with Liquid Crystal Display Device **100**

In the embodiments described above, the liquid crystal television is taken as an example of the electronic device **2000** that is equipped with the liquid crystal display device **100**. In addition to the display used in the liquid crystal television, the liquid crystal display device **100**, to which the invention is applied, may be used as a personal computer display, a digital signage display, and a display for an electronic device, such as a car navigation device, and a PDA.

The entire disclosure of Japanese Patent Application No. 2011-178257, filed Aug. 17, 2011 and No. 2012-120521, filed May 28, 2012 are expressly incorporated by reference herein.

What is claimed is:

1. A liquid crystal display device comprising:

a first metal frame including a bottom plate;

a light guide plate having a main surface and a side surface, arranged such that the main surface overlaps the bottom plate of the first metal frame;

a plurality of light emitting elements arranged along the side surface and each of the plurality of the light emitting elements having a light emitting surface facing the side surface;

a light source substrate having a mounting surface on which the plurality of the light emitting elements are mounted;

a light source support member made of metal including a substrate support plate portion supporting the light source substrate, the substrate support plate portion contacting a rear surface of the light source substrate;

a liquid crystal panel disposing in an opposite direction to the first metal frame with respect to the light guide plate;

a second metal frame including a front plate covering a peripheral area of the liquid crystal panel; and

a resin frame including a plate-shaped support portion to interpose the light guide plate between the bottom plate of the first metal frame and the plate-shaped support portion, and including an opening between the light source support member and the second metal frame,

wherein the light source support member has a first contact portion that contacts the first metal frame and a second contact portion that extends through the opening and contacts a bottom surface of the second metal frame that is parallel to the main surface through the opening; and

wherein a top surface of the second contact portion that extends through the opening and contacts the bottom surface of the second metal frame does not protrude from a top surface of the resin frame.

2. The liquid crystal display device according to claim **1**, wherein the light source support member is completely disposed away from the light guide plate in a plane view from a normal direction of the main surface.

3. The liquid crystal display device according to claim **1**, wherein the resin frame is between the first metal frame and the second metal frame.

4. A liquid crystal display device comprising:

a liquid crystal panel;

a light guide plate having a main surface and a side surface;

a plurality of light emitting elements arranged along the side surface;

a light source substrate having a mounting surface on which the plurality of the light emitting elements are mounted;

a light source support member made of metal including a substrate support plate portion supporting the light source substrate;

a metal frame accommodating the liquid crystal panel and the light source support member, and including a front plate covering a peripheral area of the liquid crystal panel; and

a resin frame disposed between the light source support member and the front plate, and including an opening between the light source support member and the front plate,

wherein the light source support member has a contact portion that extends through the opening and contacts a bottom surface of the front plate that is parallel to the main surface through the opening; and

wherein a top surface of the contact portion that extends through the opening and contacts the bottom surface of the front plate does not protrude from a top surface of the resin frame.

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